

Iowa RBCA

Tier 2 Bedrock Software

Version 1.20

Software Users Manual

January 2004

## What's New in Version 1.20

Changes in the software from Version 1.01 to Version 1.20:

### **Bug Fixes:**

The correct x-y location was not being displayed for the soil gas maximums. This has been fixed.

There was a problem with an incorrect heading being printed on page 10 for the situation where the user had selected groundwater monitoring well at the soil source as "NO", although the correct results were shown on page 10. This has been fixed.

**Public Water Supply Wells:** The risk criteria for public water supply wells did not take into account that if they are within 1,000 feet of the sources, they also function as drinking water wells and must also meet drinking water well risk criteria. Public water supply wells within 1,000 feet of the sources are now also subject to the risk classification criteria for drinking water wells within 1,000 feet. Questions have been added to allow the user to identify this situation, and the appropriate risk classification is applied by the software.

**Soil Gas Analysis:** Soil gas analysis now includes the 14-day and 6-month rules when assigning a concentration to a location and determining whether confirmation sampling has been completed for the groundwater vapor to enclosed space pathway. Previously only the 2 most recent samples had been examined. See section 14.2.1 for an explanation of the 14-day, 6-month rules.

**Risk Classification for Soil Vapor, Soil to Plastic Water Line:** In a situation where the contoured plume is very small the software could assign a risk classification of N to a receptor that is H based on a visual inspection of the receptor identification plume. The algorithm for determining the risk classification has been significantly improved for this situation and this is much less likely to happen.

**Soil Gas Monitoring Plan:** The summary table and comments/justification for a Soil Gas Monitoring Plan have been added to the software. The summary table and comments/justification item has been added to the Tier 2 checklist, and is printed from the software.

**Field Screening Results/Soil Boring and Monitoring Well Placement:** The Field Screening Results/Soil Boring and Monitoring Well Placement item has been added to the report checklist. This item is printed from the IDNR, Iowa Tier 2 Report Form-MS Word Files.

**Corrective Action Legend:** Two new items have been added to the corrective action legend: 12. Zoning, and 13. For actual PWL, GW > 3 feet. The corrective action legend is now being printed as part of the Tier 2 Bedrock, Summary of Pathway Evaluations page.

**Report Checklist:** The checklist has been revised to include additional items, and has page numbers for all items printed from the software.

**Page numbers:** All items printed from the software now have page numbers.

**Printing Order:** Items on the print menu are now printed in the order they are required in Tier 2 Bedrock report. Actually, they are printed in reverse order so when printing is done they should be in the order required by the report.

**Titles:** Titles of the Soil Leaching Corrective Action Map, Soil Plume Map and Groundwater Contamination Map print outs have been changed so they match the titles shown on the checklist.

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## 1.0 INTRODUCTION

This user manual describes the Tier 2 **Bedrock** software. The software and procedures are applicable to Tier 2 assessments of “BEDROCK” sites designated “GRANULAR” or “NON-GRANULAR”. This software will be referred to as the “Tier 2 Bedrock” software. The “normal” Tier 2 software will be referred to as the “Tier 2/SMR” software.

If your site is not defined as a Bedrock site or is an “Exempt Granular” Bedrock site you should **not** use this software. You should use the “normal” Tier 2/SMR procedures and software (Tier 2/SMR, version 2.XX). At the time of this writing the most recent version of the Tier 2/SMR software is 2.40.

Special procedures are used for Bedrock sites. Groundwater transport modeling is not done for bedrock sites, either because the bedrock site appears to behave in a non-granular manner or information is not available regarding the groundwater source areas and concentrations.

This manual will cover some of the procedures and policies implemented in the software for bedrock site assessment and risk classification. However, this manual is not official Iowa Department of Natural Resources (DNR) policy. Official policy is found in following sources: Chapter 135 of the Iowa Administrative Code (IAC), (referred to as the “Rules”), and the “Tier 2 Site Cleanup Report Guidance”, (referred to as the “Guidance”). The most recent version of the Guidance is 2.17, May 1999.

The web page, [www.iowadnr.com/land/ust/index.html](http://www.iowadnr.com/land/ust/index.html), contains addition information on the Underground Storage Tank (UST) and Leaking Underground Storage Tanks (LUST) programs of the DNR, including contact information for DNR LUST personnel. You are encouraged to visit this site, particularly the Groundwater Professional Bulletin Board, which can be reached from the above web site or directly at [www.iowadnr.com/land/ust/gwpbulletinboard/ustgwpbbindex.html](http://www.iowadnr.com/land/ust/gwpbulletinboard/ustgwpbbindex.html).

**In the Rules, bedrock assessment is covered in detail under 135.10(3), Bedrock Assessment. In the Guidance, bedrock assessment is discussed in detail in Chapter 4, Bedrock Assessment, and in Section 6.6, Bedrock Pathway Assessment Attachments. Bedrock monitoring requirements are in Sections 5.4.9 and 5.4.10 of the Guidance.**

The procedures used to evaluate bedrock sites and non-bedrock sites are not the same for most pathways. You may be familiar with “normal” Tier 2/SMR procedures. You should not assume the procedures are the same for a Tier 2 Bedrock site.

Your first step is to determine which software (either Tier 2/SMR or Tier 2 Bedrock) should be used for evaluation of your site. Criteria defining a bedrock site can be found in Chapter 4 of the Guidance. If your site meets the criteria for non-granular bedrock or granular bedrock, you should use this software to evaluate your site. Otherwise, use the “normal” Tier 2/SMR software.

If you have questions regarding the software you may contact:

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## 2.0 INSTALLING THE SOFTWARE

The Tier 2 Bedrock software is written in Visual Basic 6.0 (Service Pack 5). The software will run under Microsoft Windows® 95, 98, NT, 2000 or XP. The software will not run under Windows 3.1® or earlier versions of Windows®.

Instructions for installing the software are available on the DNR web site, where you download the bedrock software.

## 3.0 GETTING STARTED

It is assumed you are familiar with the “normal” Tier 2/SMR software, concepts, procedures and Guidance. For example, it is assumed you are familiar with the concept of a protected groundwater source, a confined space residential receptor, a drinking water well, and other receptor types defined for Tier 2. Please review the “normal” Tier 2/SMR as needed.

To start the software, from “Start”, “Programs” in Windows select “Tier 2 Bedrock, V1.20”. The form you see when you start the program will be referred to as the main form. All features of the software can be reached from the main form. In many ways a Tier 2 Bedrock analysis is “simpler” than a normal Tier 2 analysis.

Two example files are included. One example file is for Non-granular bedrock (t2bnongranexamp.t2b) and one example file is for granular bedrock (t2bgranexamp.t2b). This manual is best understood when you open the appropriate file and follow along. For now open the non-granular bedrock example file (t2bnongranexamp.t2b).

Several pathways are the same for both Non-granular or Granular bedrock. In particular the Soil Vapor to Enclosed Space Pathway, the Soil to Plastic Water Line Pathway, the Groundwater Vapor to Enclosed Space Pathway and the Water Supply Wells Pathway. We will discuss these pathways first.

The procedures for groundwater ingestion, groundwater to plastic water line, and groundwater to surface water body are different for Non-granular and Granular bedrock, and we will discuss these pathways last. For a particular site you will be doing either a non-granular or a granular analysis, but not both.

### 3.1 Where Stuff is Printed From

Most of the tables that can be printed by the Tier 2 Bedrock software can be printed from the “Main Form Print Menu”, reached by clicking the “Print Menu” button on the main form.

The following information must be printed from a specific form.

Receptor Details for Granular Bedrock: Click the “Receptor Details” button in the “Granular MW Select” frame. Click the “Print Menu” button on the form.

Granular Bedrock Monitoring Plan: Click the “Granular” button in the “GW Monitoring Plan” frame. Click the “Print” button.

### Maps/Plots

All maps and plots must be printed from a specific form.

Receptor identification plumes for Groundwater to Plastic Water Line and Groundwater to Surface Water Bodies: Click the “GW to PWL/SWB” button in the “Receptor ID” frame.

Receptor identification plumes for Groundwater Vapor to Enclosed Space: Click the “Groundwater Vapor” button in the “Receptor ID” frame.

Receptor identification plumes for Soil Vapor to Enclosed Space and Soil to Plastic Water Line: Click the “Soil Vapor/PWL” button in the “Receptor ID” frame.

Monitoring maps for granular bedrock: Click the “Monitoring Maps” button in the “Granular MW Select” frame.

Monitoring map for non-granular bedrock: Click the “Monitoring Map” button in the “Non-Granular” frame.

Soil Leaching Corrective Action Map: Click the “Soil Leaching” button in the “Corrective Action Map” frame.

Groundwater Contamination Map: Click the “Groundwater” button in the “General Contouring” frame.

Soil Contamination Map: Click the “Soil” button in the “General Contouring” frame.

Soil Gas Contamination Map: Click the “Soil Gas” button in the “General Contouring” frame.

## **4.0 FILE FRAME**

### **4.1 Open, New, Save, Save As**

After you start a new project you should periodically save the information to a project file. To save the information, click “Save” in the “File” frame. If there is no “active” project file, this will bring up the “Save As” form. Enter a file name and click “Save”. The default extension for Tier 2 bedrock files is \*.t2b, and you should use the default extension. You do not need to enter the default extension as part of the file name, it will be added automatically. You should use the site LUST number as the file name. You are required to use the LUST number as the file name for the data file you send to the DNR as part of the Tier 2 Bedrock site report.

When you have an active project file name, the full path name will be shown at the top of the main form after the title (Iowa Tier 2 – BEDROCK V1.20/ “active file name”). When you have an active file, clicking “Save” will automatically update the active file. Use “Save As” if you wish to save the current information to a different file.

Clicking “New” will clear the current information from the software and clear the active file name, essentially “resetting” the software. You will be warned before “New” is carried out. You should make sure you have saved any unsaved information in the software before you follow through on a “New” selection.

You use “Open” to access an existing data file. Files with an extension of \*.t2b will automatically be displayed. Opening a file will clear all existing information from the software, and replace it with the information from the file. If you have existing information in the software, you need to save before you open an existing file.

**Important:**

*The data files for Tier 2 Bedrock are ASCII files and can be opened and viewed with a word processor. **I would strongly recommend against this.** You should certainly not open the files in a word processor and then save the files from the word processor. Word processors have program-specific formats. If you modify or save the files from a word processor, the Tier 2 Bedrock program may not be able to properly read the data.*

*If you feel the need to view a data file, do not work with the original file. Copy the file, give a new name to the copied file, and open the copied file. If you want to make changes, make those changes to the copied file, then test it. It is recommended you use Notepad™ to look at the copied file. Notepad™ is an ASCII editor and will save changes in ASCII format.*

If you believe you have a corrupted data file, LaDon Jones may be able to correct the problem. Send him the file as an e-mail attachment (\*.t2b) or on a floppy disk, with a detailed note describing the problem.

**4.2 Tier 2 Bedrock and Tier 2/SMR Data Files**

Unlike the Tier 2/SMR software, which stores the data in two files (\*.tv2, \*.t2d), the bedrock software stores the data in a single file (\*.t2b). The Tier 2 Bedrock and Tier 2/SMR software files are not compatible; that is you can not open a Tier 2 Bedrock file (\*.t2b) in the Tier 2/SMR software and you can not open a Tier 2/SMR file (\*.tv2) in the Tier 2 Bedrock software. Generally, you would do either a “normal” Tier 2 assessment of a site or a Tier 2 Bedrock assessment, but not both.

If you have groundwater, soil, or soil gas data in a Tier 2/SMR you would like to transfer to the Tier 2 Bedrock software:

1. Start up both Tier 2/SMR and Tier 2 Bedrock.
2. Open the file in Tier 2/SMR. Go to the data form. Select and Copy the data (Edit).
3. Go to the data form in the Tier 2 Bedrock software. Paste the data (Edit).

In short, you can use the Windows clipboard to copy data from the Tier 2/SMR software to the Tier 2 Bedrock software, and vice-versa.

The usual information you will copy in this manner is groundwater data, soil data and soil gas data. All other information will generally need to be entered directly into the Tier 2 Bedrock software (although, you may copy/paste data from text boxes, like Soil Gas Methods, using Ctrl-C (copy) and Ctrl-V (paste)).

**4.3 Printer**

The “Printer” button in the “File” frame can be used to select the default printer. You can also specify whether the orientation is landscape or portrait. This is the only information used by the software. For most print outs the software will automatically select the page orientation, regardless of the default printer settings. However, printouts of maps/plots are affected by the printer orientation.

You can also set the default printer and printer properties outside of the Tier 2 Bedrock software, using the Windows Control Panel.



#### **4.4 Exit**

When you wish to exit the program, click the “Exit” button. This will bring up a dialogue box for you to confirm your selection. Any unsaved data in the software will be lost when you exit the program. Make sure you have saved the data to a file, as needed, before you exit the software.

#### **4.5 About**

The “About” button will show the software name, version and date. You can check this to confirm the software version.

### **5.0 TIER 2 REPORT – BEDROCK CHECKLIST**

A checklist is required as part of the Tier 2 Bedrock report. The checklist is printed from the software. To print the checklist, click the “Print Menu” button on the main form. Select as the item to print “Tier 2 Report - Bedrock Checklist”. You mark the items manually on the printed checklist as you generate and assemble the report.

### **6.0 SITE IDENTIFICATION – SITE ID**

Click the “Site ID” button in the “Site Identification” frame to activate the “LUST SITE IDENTIFICATION” form. The information you enter in this form is printed as part of the cover page of the Tier 2 Bedrock SCR and is basically identical to the information in the Tier 2/SMR site identification form.

The information is used to identify the site, the responsible party, the certified groundwater professional and the proposed site risk classification. When you start a new project file you should enter the “LUST No.” right away. The LUST number is printed on all graphs and tables produced by the Tier 2 Bedrock software.

Normally the site “Classification” and whether you “Recommend” Tier 3 or Correction action is set after you complete your Tier 2 analysis.

Except for signatures, the software will print all the information required on the Tier 2 Bedrock SCR cover page. To print the Tier 2 cover page click the “Print Menu” button on the main form and select “Cover Page”.

When you are done, click “OK/Back” to return to the main form. If you click “Cancel” you will be asked to confirm your cancellation. If you confirm the cancellation you will be returned to the main form but the “Site Identification” information will not be updated.

### **7.0 SITE CARTESIAN COORDINATE SYSTEM**

To use the Tier 2 Bedrock software you must define a Cartesian coordinate system for your site. X always increases from left to right. Y always increases from bottom to top. It is recommended you select North as vertically upward (Positive Y). The location of the coordinate system origin (0,0) is up to you.

In the Tier 2 Bedrock software the length unit is always feet. Do not enter the units, just the values for x and y.

The locations for all monitoring wells, soil samples, receptors, etc. are specified using the Cartesian coordinate system for the site.

Information on the site coordinate system is found in Section 4.4 of the Tier 2/SMR Software Users Manual.

## **8.0 CONTAMINANT DATA: GROUNDWATER, SOIL AND SOIL GAS**

All soil, soil gas, and groundwater contaminant data ever measured at the site or obtained during site investigations should be entered into the software (Tier 2 Guidance, Sections 2.1.1, 6.4.1). Soil and groundwater samples from releases of petroleum-regulated substances must always be analyzed for the presence of benzene, toluene, ethylbenzene, and xylenes (BTEX). Additionally, if the release is suspected to include any petroleum-regulated substance other than gasoline or gasoline blends, or if the source of the release is unknown, the soil and groundwater samples must also be tested for the presence of total extractable hydrocarbons (TEH) (Tier 2 Guidance, Section 1.5). Appendix F of the Tier 2 Guidance contains information on “Using Data Acquired Prior to August 15, 1996”.

The Tier 2 Bedrock software manages and organizes the sample data automatically. The criteria used for data selection and the procedure for modifying the data selection are discussed later.

**Important Note:** You should not enter a quote (“) anywhere in the Tier 2 Bedrock software. The quote is used as a separator in saving the information to a file. Entering a quote may cause problems when the software attempts to read a previously saved data file.

### **8.1 Water Sample Data from Water Supply Wells**

Water sample data from water supply wells (drinking water wells, nondrinking water wells, public water supply wells) should not be entered in the groundwater sample data form. Only groundwater sample data from groundwater monitoring wells should be entered in the groundwater sample data form. Entering water sample data from water supply wells into the software is discussed in Section 16.0.

### **8.2 Groundwater Sample Data from Monitoring Wells**

To enter the groundwater sample data from monitoring wells, click the “GW Data” button on the “Enter Data” frame. This will bring up the “Tier 2 BEDROCK, Groundwater Sample Data at Monitoring Wells” form.

**Important:** Only groundwater data from groundwater monitoring wells or boreholes should be entered in the Groundwater Sample Data at Monitoring Wells form. Groundwater sample data from water supply wells (drinking water well, nondrinking water wells, public water supply wells) are entered in a different form in the software. The data form for entering groundwater sample data from water supply wells is reached by the “Water Supply Wells” button in the “Receptors” frame. See Section 16.0.

The groundwater sample data form in the Tier 2 Bedrock software is exactly the same as the groundwater data form in the Tier 2/SMR software. If you are familiar with entering groundwater data into the Tier 2/SMR software, you may wish to skip this section.

Please see the Tier 2 Guidance, Section 6.4.1, for additional information on entering groundwater, soil, and soil gas data.

The sample data is input by row. Each groundwater analytical sample occupies one row. To start, click on the cell under “Well/BH Label” and type in the well label. To move to the next column, press the enter key, use the arrow keys, press the Tab key, or place the mouse cursor on the cell you want to move to and click the left mouse button.

**No Data:** For any column for which a value is not available enter “n” or “N”, to indicate no information. You must have an entry in every column for a sample, but you can enter “N” for any column, except the first four columns. You must have a Well/BH Label, a sample date, and an (x, y) location for each sample.

We will now discuss the individual columns:

**Well/BH Label:** Enter the label for the well or borehole (BH) sampled. The column will accept any text or numeric inputs, including commas.

The text does not need to fit within the column space shown. You can change the width of any column by placing the mouse cursor on the vertical column separator in the top row (the row with the column labels); click and hold the left mouse button and drag left or right.

**Sample Date:** Enter the date the sample was collected. The format is month/day/year. You can use a variety of formats to enter the date, but when you return to the Groundwater Sample Data form, or print the date, the date is always shown by mm/dd/yyyy.

For example, you can enter March 4, 1998, in the Sample Date column as:

March 4, 1998  
3/4/1998  
3-4-1998

It is recommended you enter all four digits for the year, but it is not required. If you use two digits for the year you should return to the form to make sure the software has converted the two-digit year to the correct four-digit year.

**X,Y Location:** Enter the (x,y) location of the well or bore hole based on the site Cartesian coordinate system. The units are feet. Do not enter the units, just the location in feet.

**Chemical Concentration Columns:** Enter the values for benzene, toluene, ethylbenzene, xylenes (BTEX); total extractable hydrocarbons as diesel (TEH-D); total extractable hydrocarbons as waste oil (TEH-WO); and naphthalene (Naph.). The units for groundwater concentrations are micrograms per liter, or µg/L. Do not enter the units, only the value of the concentration in µg/L.

Check the units reported on the original laboratory data sheets to ensure the correct unit conversion is applied. For example, TEH in groundwater is often reported in milligrams per liter, or mg/L, on the laboratory sheet and must be converted to µg/L for the Tier 1 and Tier 2 evaluations (Tier 2 Guidance, Section 6.4.1). The Tier 2 Guidance, Section 6.4.1, discusses when TEH must be sampled at your site.

If you do not have data for a chemical enter “n” or “N” in the column.

**Samples Below Detection Limits:** For samples with concentrations below the method detection limit, or laboratory reporting limit (e.g., “non-detect”), you must enter “<” followed by the detection limit. For example, if the sample is less than the method detection limit for a chemical and the detection limit is 10 µg/L, enter <10.

**Free Product:** The free product column is used to indicate if free product is present and what type it is. Valid entries are (use just the letter, for example G for Gasoline):

G or g: Gasoline  
 D or d: Diesel  
 W or w: Waste Oil  
 U or u: Free product is present, but type is unknown.  
 N or n: free product is not present.

**Use FP Defaults:** If free product (FP) is present (any entry other than N in the “Free Product” column), one of two cases could occur:

Case 1: The groundwater beneath the free product has been sampled for BTEX and/or TEH. Place the measured groundwater concentrations for the chemicals in the appropriate columns and set “Use FP Defaults” to “n” or “N”. **You are required to sample groundwater beneath free product as part of the RBCA process.**

Case 2: The groundwater beneath the free product has not been sampled for BTEX and/or TEH. Set “Use FP Defaults” to “Y”. When you type “Y” or “y” in the “Use FP Defaults” column and a free product type has been specified in the Free Product column, the software will ask you to confirm you want to use free product defaults for chemical concentrations. If you answer yes, “y” or “Y”, to the message box, free product defaults will be inserted for BTEX and/or TEH concentrations. If you change “Y” to “N” in the Use FP Defaults column, any previously-inserted defaults are left in the chemical concentration columns. If you need to change previously-inserted free product defaults, you will need to type in the values in the chemical concentrations columns. Note: Using “Free Product Defaults” generally only applies to using data from a pre-RBCA report (Tier 2 Guidance, Section 6.4.1). Do not enter FP defaults for every time FP is noted: only the last time it was present where no samples were analyzed.

### **Groundwater Surface Elevation, Top-of-Casing Elevation, Top-of-Screen Elevation, Static**

**Groundwater Elevation:** Enter the values requested in feet above mean sea level (feet ASL). Enter only the value, not the units. If the information is not available, enter “n” or “N”.

**Hydraulic Conductivity:** You are required to estimate the hydraulic conductivity (K) at your site. Generally this is done by slug testing a minimum of three monitoring wells. The analysis of slug test data must be done using the Bouwer-Rice method (Bouwer, H., 1989, The Bouwer and Rice Slug Test – An Update, Groundwater, Vol. 27, No. 3, pg. 304-309). For additional information on K estimation and the slug test information you are required to send to the DNR, see the Tank Memo dated March 29, 1999 (Volume 3, Issue 1), and the Tier 1 Guidance (page 24 and 34, Hydraulic Conductivity Well Diagram). You may obtain a copy of a DNR paper titled “Recommended Method for the Determination of Hydraulic Conductivity” by contacting Bonnie Garrison at 515-281-6010.

If slug testing was performed, enter the estimated K in meters per day (m/d). A K value of 5 m/d may be used when the recharge rate of the well is too rapid to be accurately measured (Tier 2 Guidance, Section 2.4). Enter “n” or “N” if there is no data.

Groundwater at bedrock sites is considered a protected groundwater source regardless of the K values (Tier 2 Guidance, 4.2.2). The bedrock software assumes a protected groundwater source is always present. Even if all K values are less than 0.44 m/d, the Tier 2 bedrock software will still assume a protected groundwater source is present.

**TDS:** A protected ground source is a saturated bed or formation, or group of formations which has a K of 0.44 m/d or greater and a total dissolved solids (TDS) of less than 2,500 mg/L. For this reason, if any of the K measurements exceed 0.44 m/d, groundwater samples should be collected from the wells used to determine K, and analyzed for TDS (Tier 1 Guidance, page 24). If TDS values exceed 2,500 mg/L, the saturated unit is not considered a PGWS. If TDS were measured, enter the concentration in mg/L. Enter “n” or “N” if there is no data.

**Automatic Number Formatting:** The concentration data is automatically formatted as you type in the data. For example, if you type in a concentration of “20000” the number is automatically formatted as “20,000”.

**Fix Cols/Unfix Cols Button:** Clicking the “Fix Cols” button will fix the first two columns. As you scroll the grid to the right the Well/BH label and Sample Date Column will remain in place to assist with entering the proper values in the far right columns. When the columns are fixed, however, you cannot type in new data in the first two columns. If the columns have been fixed the button will show “Unfix Cols”. Click the button to unfix the first two columns.

**Sort:** The sort button will sort the data, first by location (x,y), then by date at a location. Starting with the first sample the software will find all other samples within a 5-foot radial distance and group the samples together. The software then moves to the next sample not assigned a location and finds all following samples within 5 feet. This continues until all groundwater samples have been assigned a location. All samples assigned to the same x-y location are then sorted by date, from the oldest to the most recent sample.

To sort the data click the “Sort” button. You are not required to sort samples. The software maintains an internal copy of the sorted data for computational purposes.

**Editing values in the grid:** To edit a value in the table, click on the cell and press the F2 key. Edit the value in the text box above the grid. Press enter to update the table with the edited value. Press the “Esc” button to return to the grid without editing the value.

## **EDIT:**

### **Copy/Paste/Cut**

The “EDIT” menu at the top left of the form is a drop down menu with editing commands. The program has spreadsheet-type Copy and Paste capabilities. You can also Copy and Paste to and from other Windows programs (the Windows Clipboard is used). To select an area for copy/paste/cut, click and hold down the left mouse button and drag the mouse, or hold down the shift key and use the arrow keys.

### **Insert Rows**

To insert rows, click the row where you want to insert. Click “Edit”, then “Insert Rows”. Type in the number of rows you wish to insert and whether you want the insertion above or below the current row, then click OK.

### **Delete Rows**

To delete rows, first select the rows you want to delete. One method of selection is to click the first row you want to delete with the left mouse button, hold down the left mouse button, and drag to select the rows you want. You can also hold down the Shift key and use the arrow keys to select rows. Click

“EDIT” then “DELETE ROWS” to delete the selected rows. The software will confirm you want to delete the selected rows if they are not empty. Once rows are deleted the information is lost.

**Cancel:** If you click “Cancel” on the menu you will need to confirm the cancel. If you confirm the cancel selection, any changes you have made since entering the Groundwater Sample Data form will be ignored. You will be returned to the main form.

**OK/Back:** When you are done entering or modifying data, clicking “OK/Back” will update the stored groundwater sample information with the information currently displayed in the grid. When you click “OK/Back”, the data is first checked for any formatting errors. If errors are present, a message box will inform you of the error. “OK/Back” will not update the data and leave the form until all errors are cleared.

**Identical Sample Check:** As part of error checking, the software will check for identical samples. Possible identical samples are flagged if two groundwater samples have the same well label, sample date, (x, y) location, and chemical concentrations for BTEX, TEH-D, TEH-WO and naphthalene. Identical samples can create problems with retaining your selections for groundwater sample data to “ignore” (discussed later).

If the samples are truly identical and entered twice by mistake (the most likely case) one of the samples should be deleted. If they are not truly identical samples the best approach is to modify the label of one of the samples slightly so the software does not see the samples as identical.

**Printing Groundwater Sample Data:** To print the groundwater sample data use the “Print Menu” button on the main form. Select “Groundwater Sample Data” in the print menu.

### 8.3 How Tier 2 Bedrock Organizes Groundwater Sample Data

The Tier 2 program organizes and analyzes the groundwater sample data from monitoring wells. This is done automatically. However, you should be aware of how the software evaluates the data and how the reduced data is used in the Tier 2 Bedrock software.

The groundwater analytical data is first grouped by location (x, y). Samples within a 5 feet radial distance are treated as coming from the same location. The samples at the same location are sorted by date, from the oldest to the most recent.

The location a groundwater sample is assigned can be affected by the order in which the data is listed in the table. The software looks at the location of the first groundwater sample in the grid. It then searches the other groundwater sample locations in the grid in the order shown. Any sample within 5 feet radial distance is considered to be at the same location and the sample is not considered again. The software then moves down in the grid to the next sample not assigned a location. All following samples are checked against this location. This continues until all samples have been assigned a location. If a number of samples are close together (i.e., four samples on a line, each spaced 4 feet apart), the order of the samples in the grid can affect their location assignment.

Consider the following example: Assume the following three samples are available from two wells. For purposes of illustration, we will look at benzene and toluene. Assume monitoring well MW-3 was no longer usable after 1994, and MW-8 was installed as a replacement:

Well	Sample Date	X (ft)	Y (ft)	Benzene (µg/L)	Toluene (µg/L)
MW-3	04/05/1992	100	100	2,000	4,000
MW-3	04/09/1994	100	100	1,000	5,000
MW-8	04/12/1997	101	103	800	4,700

Regardless of where the three samples are entered in the Groundwater Sample Data form, the software will organize the samples as shown. MW-8 is treated as a sample from the same location as MW-3 because it is within 5 feet (radial distance).

The software will assign a benzene and toluene concentration to a location based on all the groundwater samples assigned to the location. For each chemical, the criteria for assigning a concentration to a location are either the maximum of the two most recent samples or the most recent sample if steady and declining criteria are met. Steady and declining criteria state: three samples at least six months apart, cannot have concentrations increasing more than 20% from one sample to the next, and concentrations cannot increase more than 20% from the third to the most recent sample.

In the example above, the benzene concentrations meet steady and declining criteria, so the benzene concentration used for the location is the most recent sample, 800 µg/L. Toluene does not meet steady and declining criteria, so the maximum of the two most recent samples is assigned. For toluene, the second sample concentration is assigned to the location (5,000 µg/L). Chemical concentrations assigned to a location may be from different sampling dates and/or wells. This approach is applied to all chemicals.

For each chemical, a single concentration is assigned to each sampling location. The chemical concentrations are used for contouring, determination of maximum concentrations, and for generating receptor identification plumes.

For risk classification, groundwater concentrations are assigned to locations as discussed above. However, for risk classification, the concentration values evaluated at a location will vary, depending on whether the site is granular or non-granular. This will be discussed later in the sections on risk classification.

If you are still in the “Groundwater Sample Data” form, click “OK/Back” to return to the main form.

## 8.4 Soil Sample Data

The grid for entering Tier 2 Bedrock soil analytical data is exactly the same as for the Tier 2/SMR software. If you are familiar with entering soil data in the Tier 2/SMR software you may wish to skip this section. The Soil Sample Data form is similar to the Groundwater Sample Data at Monitoring Wells form, and only the differences are discussed. To reach the “Soil Sample Data” form, click the “Soil Data” button in the “Enter Data” frame on the main form.

One row of the grid (table) is used for the results from one soil sample analysis. See the Tier 2 Guidance, Section 6.4.1 and Appendix F, for additional information on soil analytical data.

**Use TPH/TEH Defaults:** RBCA (Risk Based Corrective Action) is based on individual chemical concentrations. Be sure to look at the lab data sheets to see if individual concentrations are available. If only total petroleum hydrocarbon (TPH) and/or total extractable hydrocarbon (TEH) concentrations are available, the “Use TPH/TEH Defaults” column will compute default BTEX values, using the

assumptions listed in the Tier 2 Guidance (Appendix F), and insert the computed values in the BTEX chemical concentration columns.

If you have the individual chemical concentrations you must enter the actual measured values for the individual concentrations. Actual data may be much less restrictive than the default values. If you also have a TPH and/or TEH value for the sample you should enter it. You should not “Use TPH/TEH Defaults” if you have the actual concentrations for the individual chemicals. Place an N in the column for this situation.

To use the default conversions for BTEX if you only have TPH and/or TEH concentrations for the sample, type a “Y” for Yes in the “Use TPH/TEH Defaults” column. The software will ask you to confirm your choice.

If you wish to change from yes to no, type an “N” in the column. If you change from yes to no the software does not remove the previously-inserted defaults. You must replace the default concentrations in the chemical concentration columns by manually typing in the actual measured concentrations.

Automatic Number Formatting: Numeric data is automatically formatted as it is entered. For example if you type in a concentration of 1000 the number is automatically formatted as 1,000.

**Identical Sample Check:** As part of error checking the software will check for identical soil samples. Possible identical samples are flagged if two soil samples have the same well label, sample date, (x, y) location, sample elevation, and chemical concentrations for BTEX, TEH-D, TEH-WO, and naphthalene. Identical samples can create problems with data analysis and retaining user selections regarding which soil samples to “ignore”. If the samples are truly identical or entered twice by mistake (the most likely situation) one of the samples should be deleted. If they are not truly identical, the best approach is to modify the label for one of the samples slightly so the software does not see the samples as identical.

**Printing Soil Sample Data:** To print the soil sample data, use the “Print Menu” button on the main form and select “Soil Sample Data”.

## 8.5 How Soil Sample Data is Evaluated

Soil sample data analysis for Tier 2 Bedrock is the same as Tier 2/SMR.

The software evaluates soil data similarly to groundwater data: samples are grouped by location, then sorted by date at each location (oldest to most recent). Samples within a 5-foot radial distance are considered as representing the same location.

In contrast to groundwater data, the soil concentration from the most recent sample for a chemical is assigned to the location. If there are multiple samples from different depths on the same date the maximum concentration is used to represent that date.

The software groups soil samples by location, based on the order the data is encountered in the grid. For example, the software looks at the location of the first soil sample in the grid. It then searches the other soil sample locations in order in the grid. Any sample within a 5 foot radial distance is considered the same location and the sample is not considered again. The software then moves down in the grid to the next sample not assigned a location. All following samples are checked against this location. This continues until all samples have been assigned a location. If a number of samples are near each other (four samples on a line, each spaced 4 feet apart), the order of the samples in the grid can affect the assigned location.



When selecting the (x, y) locations for soil samples taken on the same date (e.g., tank closure, over-excavation) selecting locations at least 5 feet apart will ensure such samples are treated independently. Samples lumped together because they are less than 5 feet apart may adversely affect the size of the contoured plumes.

If you are in the “Soil Sample Data” form, click “OK/Back” to return to the main form.

## 8.6 Groundwater and Soil Data Adjustment

Groundwater data adjustment is the same for Tier 2 Bedrock and Tier 2/SMR. However, groundwater data adjustment is only available for groundwater sampling data from monitoring wells. It is not available for groundwater sampling data from water supply wells.

Generally speaking, you should enter all groundwater and soil analytical data available for the site (Tier 2 Guidance, Sections 2.1.1, 6.4.1). The software will apply the specified procedures for organizing and reducing the data. The data reduction is done automatically using all the data, except samples you specifically exclude. If you exclude a sample you will need to provide a justification. There may be situations where not using a sample as part of the Tier 2 analysis can be justified. For example, perhaps the location of a soil sample has since been excavated. To exclude a sample from the evaluation process, you must tell the software which samples to “ignore”.

### Groundwater Data Adjustment

To see how this is done for groundwater data click “GW” under the “Data Adjustment” label in the “Enter Data” frame. This will bring up the “Tier 2 Bedrock, Groundwater Sample Data, Data Adjustment” form. The form will show all groundwater sample data from monitoring wells, identified by Well/BH label and sample date. The data is sorted by location, then by date at a location.

By default, the column for each chemical will show “Use”. This means the software will consider the sample when assigning concentrations to a location. To toggle between Use/Ignore, first select the cell for the sample and chemical. Press the SPACE BAR to toggle the selected cell. You can select multiple cells by clicking and holding down the left mouse button and dragging the mouse or by pressing and holding the shift key down and using the arrow keys. You can select an entire row by clicking any of the fixed columns (columns with gray shading) in the row.

If “Ignore” is shown for a cell the software will disregard the concentration for the sample when the groundwater data is evaluated. For our example we will use all the samples. Click “Cancel” to return to the main form. Using “Cancel” will ignore any changes you have made.

### Soil Data Adjustment

The procedure is similar for soil sample data adjustment. Click the “Soil” button under the “Data Adjustment” label in the “Enter Data” frame. This will bring up the “Tier 2 Bedrock, Soil Sample Data, Data Adjustment” form. The table includes a soil sample elevation column, “Elev.(ft)”, in order to distinguish between soil samples taken from different elevations in the same borehole on the same date.

When you are done, click “OK/Back” to accept the changes and return to the “Main Form”.

### How “Ignores” Can Be Lost

When you “ignore” a sample the software uses a text string to identify the sample. The text string is made up of the sample label, data, (x, y) location, concentrations, etc. In short most of the information in the sample.

If you set a sample to “Ignore”, but then go back and change the sample data, there is a good chance the ignore selection will be lost. This is because the text string identifying the sample changes when you change the sample data. For example, if you set a groundwater sample to “Ignore”, but then change the data for the sample, such as changing the label or date or a concentration, the “Ignore” selection will be lost.

If you change the sample data for an “ignored” sample you should go back and see if you need to reset the “ignore” selection.

### **8.7 Soil Gas Data**

Please see the Groundwater Professional Bulletin Board ([www.iowadnr.com/land/ust/gwpbulletinboard/ustgwpbbindex.html](http://www.iowadnr.com/land/ust/gwpbulletinboard/ustgwpbbindex.html)) under Soil Gas Sampling Guidance (posted 5/23/2000), Tank Memos dated May 14, 1999 and March 29, 1999, and the Tier 2 Guidance (Sections 1.6, 1.8, 3.3, 3.4, 4.4 and 5.4.8) for additional information on soil gas sampling.

Soil gas sampling is required for Tier 2 Bedrock (Guidance, 4.4). Soil Gas samples are used to evaluate the Groundwater Vapor to Enclosed Space Pathway. Soil Gas samples may also be appropriate for evaluating the Soil Vapor to Enclosed Space pathway. See the sections in this manual on the Groundwater Vapor to Enclosed Space Pathway and Soil Vapor to Enclosed space pathway for more information. In this section we will just discuss how to enter the data.

Click “Soil Gas Data” in the “Soil Gas” frame to activate the “Soil Gas Data” form. Use this form to enter the soil gas data you have collected.

The column “Receptor(s) Evaluated” is used to indicate the receptors or sources the soil gas sample point is being used to evaluate for the Soil Vapor to Enclosed Space pathway. For the Groundwater Vapor to Enclosed Space Pathway it is not necessary to enter the receptors evaluated: the receptor identification plume for the pathway handles this. You can type multiple entries in this column, but by default, only text that fits in the column width and one row is shown. For example, for entry three (row 3, sg3) there are four receptors listed. To see all the text you can change the row height for row 3. To do this, put the mouse cursor on the line immediately below the number 6 in the first column (“Count”). Click and hold down the left mouse button, then drag the mouse downward. Release the left mouse button. You can also change the width of columns by using the vertical lines in the first row (the row with the column labels).

If you wish to add or edit entries in the “Receptor(s) Evaluated” column the easiest method is to use the edit box (F2). Click on the row in the “Receptor(s) Evaluated” column you want to add entries to then press the F2 key. After you are done using the edit text box, press enter to accept the changes and update the grid.

The Tier 2 Bedrock software automatically does analysis of the soil gas data and risk classification for the Groundwater Vapor to Enclosed Space pathway. The software does not do analysis of the soil gas data for the Soil Vapor to Enclosed Space pathway. The Tier 2 Bedrock software does **not** automatically

determine whether soil gas sampling has passed at the soil source(s) or for a specific receptor(s) for the Soil Vapor to Enclosed Space pathway.

The “Sort” button will sort the soil gas data by location and date.

To print the soil gas data use the “Print Menu” button on the main form. Use the “Soil Gas Sample Data” option. This will print page 13 of the Tier 2 Bedrock report. The soil gas data is printed out sorted by location and date, regardless whether the data is sorted in the grid. If you have multiple entries for “Receptor(s) Evaluated”, the software will automatically adjust the row height of the printout to show all the entries, even if they are not all visible in the “Soil Gas Data” form.

When you are done click “OK/Back” to return to the main form.

## **8.8 Soil Gas Sampling Methods**

Click the “S.G. Methods” button in the “Soil Gas” frame to activate the “Soil Gas Sampling: Methods/Location (page 13)” form.

The two text boxes are used to enter information on “Soil Gas Sampling Methods” and “Soil Gas Sampling Location Justification”. The information you enter is stored in the Tier 2 Bedrock data file and printed as part of page 13 of the Tier 2 report. The information is automatically printed when you print out the soil gas data.

## **8.9 Maximums**

Click the “Maximums” button in the main form. The maximum concentrations for the groundwater data from monitoring wells, soil data, and soil gas data are displayed. The maximums are the values after analysis of the data (i.e., grouping samples together within a specified distance, using the most recent sample for soil, maximum of the two most recent for soil gas, maximum of two most recent or most recent if steady and declining is met for groundwater data).

For soil and soil gas, maximums are used to represent the source concentrations and locations. For groundwater data the maximums may not be the “sources”, since groundwater monitoring wells are generally not installed where soil contamination exists, or where the release may have originated. The groundwater maximums are simply the maximums found from the groundwater sample data.

The maximums are printed when you print the “Tier 2 Bedrock Data Summary”. The Tier 2 Bedrock Data Summary print selection is reached through the “Print Menu”.

## **9.0 QUESTIONS**

After you enter your site data (groundwater, soil, soil gas) you should next answer the questions that are presented using the buttons in the “Questions” frame. The information is used to help determine the receptor types you need to evaluate. To get correct results you must answer all the questions. Your responses are included in the “Tier 2 Bedrock Data Summary” printout, page 4 of the Tier 2 Bedrock report. Use the “Print Menu” button on the main form and select “Tier 2 Bedrock Data Summary” to print page 4. For the example problem (t2bnongranexamp.t2b) the questions have already been answered.

## General

Click the “General” button in the “Questions” frame. For our example, the following answers have been selected:

Groundwater Encountered: Yes  
 Was bedrock encountered before Groundwater: Yes  
 Bedrock Category: Non-Granular Bedrock  
 GW Monitoring Well(s) at the Soil Source(s)?: No  
 SCR Conversion: Yes  
 Free Product Present: No  
 TEH-Diesel required: Yes  
 TEH-Waste Oil required: No

## Important:

**The most critical question on this form is:**

**Bedrock Category: Non-granular or granular.**

**It is critically important you make the correct selection for this question. The procedures used for evaluating groundwater ingestion, groundwater to plastic water line and groundwater to surface water body are automatically selected by the software based on your answer to this question. See Chapter 4 of the Guidance for information on making the correct selection. For now make sure the selection is Non-granular.**

Groundwater Monitoring Well at the Soil Sources: For now select, No. Your answer to this question effects risk classification for non-granular bedrock (discussed later).

At the bottom of the form you are reminded that if your site is “Exempt Granular” you should not be using this software or bedrock procedures. For “Exempt Granular” sites you should perform a “normal” Tier 2 evaluation using the Tier 2/SMR software.

You can click “OK/Back” to return to the main form or “Next” to move directly to the next set of questions. Click “Next”. If you have returned to the main form click the “GW Ingestion” button in the “Questions” frame.

## Groundwater Ingestion

Your responses in this form are used to determine whether the drinking water well, non-drinking water well, or public water supply well types need to be evaluated for non-granular bedrock.

For our example the questions are answered as shown below:

Water Supply Well Survey: Yes  
 Drinking Water Wells are present within 1,000\*\* feet?: Yes  
 Non-Drinking Water Wells are present within 1,000\*\* feet?: Yes

Public Water Supply Well Survey: Yes  
 Public Water Supply Wells are present within 1\*\* mile?: Yes  
 Public Water Supply Wells are present within 1,000\*\* feet?: Yes

For bedrock you are required to do a water supply well survey within 1,000 feet of the soil sources or the suspected sources of the petroleum release(s). All drinking and non-drinking water wells identified should be entered into the software. Although a public water supply well is, obviously, a well used for drinking water, a public water supply well is considered separately from a drinking water well. That is, public water supply wells should not be identified as drinking water wells; they are identified as public water supply wells.

You are also required to do a survey for public water supply wells within 1 mile of the soil sources or the suspected sources of the petroleum release(s). All identified public water supply wells should be entered into the software. Note that there are 2 questions for public water supplies wells, whether there are any public water supply wells within 1 mile and whether there are any public water supply wells within 1,000 feet (added at version 1.20). You must answer both questions.

There is no question in the form about whether the first encountered groundwater is a protected groundwater source. For bedrock sites the first encountered groundwater is always considered to be a protected groundwater source (Guidance 4.2.2).

### VES Receptors

Click “Next” to move to the “VES: Vapor to Enclosed Space Questions” form. Or from the main form click the “VES Receptors” button in the “Questions” frame.

Explosive Vapor Survey (See the Tier 2 Guidance, 3.3.2 Explosive Vapor Survey)

As stated in the Tier 2 Guidance: “An explosive vapor survey should be conducted, at a minimum, in the nearest subsurface enclosed spaces in all directions from the source and in any places with a history of vapor problems. Enclosed spaces for the purpose of the explosive vapor survey include buildings with basements, storm and sanitary sewers, and underground utility vaults.”

For our example the questions have been answered as shown:

Explosive Vapor Survey: True  
Explosive Vapors Identified: False  
Institutional Control, Soil Vapor: False

Please note that the institutional control question in this form only applies to the Soil Vapor to Enclosed Space Pathway.

### Soil: Soil Gas

Click “Next” or the “Soil: Soil Gas” button in the “Questions” frame on the main form to activate the “Soil Vapor: Soil Gas Questions” form. Your answers are used to determine whether or not you need to evaluate vapor receptors for Soil Vapor to Enclosed Space pathway. You are indicating whether or not you have passed soil gas sampling criteria at a soil source.

The software does not determine, based on your soil gas samples, the answers to these questions, nor does it check your answers against the soil gas data you have entered. See the Tier 2 Guidance, Sections 1.8, 3.3, and 3.4 for information on soil gas sampling and the required criteria for passing. You have to determine whether you have passed soil gas sampling criteria at a soil source.

If you have passed soil gas sampling criteria at a soil source you must answer both questions to have the software recognize you have passed. For example, you must answer “True” to, “Soil Gas sampling has been completed at the soil source location for Benzene”, and “True” to “Soil Gas target levels are not exceeded”, to receive credit for passing soil gas at the benzene soil source. If you answer “False” to “Soil Gas sampling has been completed at the soil source location for ...” and “True” to “Soil Gas target levels are not exceeded” the software will assume you have not passed soil gas sampling at the soil source for that chemical.

To summarize:

**You have passed soil gas sampling at a soil source** (This requires 2 samples). Select True for both questions.

**You have failed soil gas sampling at a soil source** (even if you have only one sample at the source). Select True for the first question (Soil gas sampling has been completed ...) and False for the second question (Soil gas target levels are not exceeded).

**You have not done soil gas sampling at a soil source.** Select False for the first question (soil gas sampling has been completed ...). Do not make a selection for the second question (Soil gas target levels are not exceeded). That is, do not select either True or False for the second question. Leave the selection blank for the second question. If you have selected either True or False for the second question, click the “Clear” button to clear your selection.

**You have not completed soil gas sampling, but have not failed.** That is, the first soil gas sample passed, but you have not done a second sample. Select False for the first question (soil gas sampling has been completed ...). Do not make a selection for the second question (Soil gas target levels are not exceeded). That is, do not select either True or False for the second question. Leave the selection blank for the second question. If you have selected either True or False for the second question, click the “Clear” button to clear your selection.

Pressing the “Click Me” button will give you a summary of how to set the options.

For our example the answer to all questions is “False”, except for Toluene, where it is indicated soil gas sampling has failed at the soil source and for Ethylbenzene, where it has been indicated soil gas sampling passed at the soil source.

### Plastic Water Line

Click “Next” or the “Plastic Water Line” button in the “Questions” frame on the main form to activate the “Plastic Water Line: Initial Receptor Evaluation” form.

The software searches the groundwater sample data you have entered, determines the shallowest measured depth to groundwater below the ground surface, and displays the result as “The shallowest depth to groundwater in the groundwater sample data is”. You need to enter the shallowest measured depth to groundwater (from the ground surface) over the LUST site. If you have other data not entered as part of the groundwater data showing a shallower depth to groundwater you should enter such information as the shallowest depth. If you have such data you could also enter the data as groundwater sample data, even if no chemical concentrations were measured (use N). The data will be used in calculating the shallowest depth to groundwater. In any case, you must enter a shallowest measured depth

to groundwater (measured from the ground surface). The software uses the entered value to evaluate the potential plastic water line receptor type.

For our example we have used the shallowest depth to groundwater found in the groundwater data, 2.16. Also for our example the response to the statement, “A plastic water line is present within 200 feet of the soil or groundwater sources,” is “False”.

### Surface Water Bodies, Designated Use

Click “Next” or the “SW: Designated” button in the “Questions” frame on the main form to activate the “Surface Water Pathway: Designated User Receptor Questions” form. For more information on Surface Water Bodies refer to Sections 3.7, 4.6 and 6.4.7 of the Tier 2 Guidance.

A survey is required to identify any designated use surface water bodies within 500 feet of the soil sources or the suspected location(s) of the petroleum release(s). If designated use receptors are present within 500 feet, identify the types of designated uses surface water bodies present.

For our example the answers are as shown below:

A survey has been done ... : Yes  
 Designated use surface water bodies are present: Yes  
 Type Present: B(CW)

### Surface Water Bodies, General Use

Click “Next” or the “SW: General” button in the “Questions” frame on the main form to activate the “Surface Water Visual Inspection: General and Designated Use” form. This form contains a series of questions used to determine if you have passed or failed visual inspection requirements for general use streams. For more information regarding visual inspection requirements refer to Sections 3.7, 4.6 and 6.4.7 of the Tier 2 Guidance.

For the purpose of visual inspection a designated use stream must meet general use criteria.

For our example the questions are answered as shown:

Surface water bodies (general or designated use) are present within 200 feet ...: Yes  
 A visual inspection has been completed of all surface water bodies ...: Yes  
 The visual inspection shows evidence of a possible petroleum sheen ...: No

With these answers you will note the bottom box on the screen shows visual inspection has passed. If you fail visual inspection you will need to identify the type of surface water body or bodies. As you answer the questions in this form, if addition responses are required, the option boxes will be activated.

Clicking the “Justification” buttons will activate text boxes where you can enter justifications. “Justifications” are printed when you print page 4 of the Tier 2 Bedrock SCR, “Tier 2 Bedrock Data Summary”. If justifications are entered they are printed as page 4a. If no justifications have been entered, page 4a will not be printed.

We have completed the required questions. You may complete the questions in any order, but all questions should be answered, particularly before you proceed to “Preliminary Pathway Evaluation Requirements”.

Click “OK/Back” to return to the “Main Form”.

## 10.0 PRELIMINARY PATHWAY EVALUATION REQUIREMENTS

The “Preliminary Pathway Evaluation Requirements” or “Receptor Type Evaluation Requirements” are an integral part of the Tier 2 bedrock software. They identify the “Receptor Types” you must evaluate for your site. It is important you complete the “Preliminary Pathway Evaluation Requirements” before you generate “Receptor Identification Plumes” and identify receptors.

The results are valid **only** if you have input the required information. In order for the results to be valid you need to have completed the following:

- Entered all groundwater monitoring well data, soil data, and soil gas data.
- Specified groundwater and soil data adjustment, if needed.
- Correctly answered all questions contained in the “Questions” frame.

These tasks have been completed for the example problem.

To see the “Preliminary Pathway Evaluation Requirements” click the “Prelim. Pathway” button beneath the “Questions” frame.

The meaning of the results in this form will be covered when we discuss each pathway in Tier 2 Bedrock.

To print the “Preliminary Pathway Evaluation Requirements” click “Print Menu” on the main form and select “Preliminary Pathway Evaluation Requirements (Page 6)”.

Click “OK/Back” to return to the main form.

## 10.1 Data Justification

Click the “Data Just.” button on the main form to activate the “Tier 2 Bedrock, Data Justification Section”.

Enter the required information in the text box.

The information you enter here will be printed as part of the “Site Hydrogeology/Bedrock Type Justification” page (page 5) of the Tier 2 Bedrock report. You can print this page from the “Print Menu”.

Click “OK/Back” to return to the main form.

## 10.2 Bedrock Justification

Click the “Bedrock Just.” button to activate the “Justification for Bedrock Type” form.

The table at the top of the form shows the hydraulic conductivity and TDS sample values entered into the software as groundwater sample data. This table is generated automatically by searching through the groundwater sample data you have entered and extracting information from each sample with hydraulic conductivity or TDS values. Both the groundwater sample data at monitoring wells and the groundwater sample data from water supply wells (see section 15.1) are searched.



You should enter all your hydraulic conductivity and TDS values in the groundwater sample data from monitoring wells or water supply wells, as appropriate.

Use the text box to enter the information required for “Site Hydrogeology/Bedrock Justification Section”.

The information you enter here is printed as part of the “Site Hydrogeology/Bedrock Type Justification” page (page 5) of the Tier 2 Bedrock report. You can print this page from the “Print Menu”. When you print page 5, the software will print the table of hydraulic conductivity and TDS values, the Data Justification (“Data Just.” button), and the text you have entered for the “Site Hydrogeology/Bedrock Justification Section”.

## 11.0 THE SOIL LEACHING PATHWAY

The Soil Leaching Pathway for Bedrock is not the same as the pathway for a Tier 2/SMR evaluation. Please see the Guidance, in particular Chapter 4, 4.2.3, 4.2.4 and 6.6.2. The soil leaching pathway is not affected by whether a site is non-granular or granular bedrock.

You are **required** to define soil contamination to the Tier 1 levels for the soil leaching to groundwater pathway, without drilling into bedrock. For all sites where soil contamination exceeds the soil leaching to groundwater Tier 1 levels, soil excavation or other active soil remediation technology **must** be conducted to reduce concentrations to the Tier 1 target levels.

The Tier 1 target levels for soil leaching to groundwater are:

Benzene mg/kg	Toluene mg/kg	Ethylbenzene mg/kg	Xylenes mg/kg	TEH-Diesel mg/kg	TEH-Waste Oil mg/kg
0.54	42	15	NA	3,800	NA

### 11.1 Preliminary Pathway Evaluation

Click “Prelim. Pathway”. The results for “Soil Leaching” are shown in the next to last row in the top table. **The results are always the same.** There is no receptor identification for the soil leaching pathway. You need to do the pathway evaluation, then generate the soil leaching corrective action map, if the pathway is high risk for any chemical.

### 11.2 Receptor Identification Plumes

There are no receptor identification plumes for the soil leaching pathway.

### 11.3 Entering Receptors

There are no receptors to enter for the soil leaching pathway.

### 11.4 Pathway Evaluation

From the main form click the “Soil Leaching” button in the “Pathway Evaluation” frame to active the “Soil Leaching to Groundwater Ingestion” form.

Prior to the pathway evaluation you should have already entered all the soil sample data and specified any soil data adjustment (if appropriate).

The first row in the top table shows the maximum soil concentrations for each chemical (Max. Conc.). The software, based on analysis of the soil data you have entered, determines these values. The second row (Target Level) shows the Tier 1 levels for soil leaching to groundwater.

The second table shows the risk classification. The classification process is very simple. If the maximum concentration for a chemical exceeds the target level the chemical is high risk (H), otherwise the chemical is no action required (N). N/A means a chemical is not applicable.

Your job is to set the last 4 columns.

Confirm. Samp.: Confirmation sampling. Set to “YES” if confirmation sampling has been completed. The column will only show “YES” or “NO”. You can press “Y” or “N” to set the column, or press the space bar to toggle YES/NO.

Corrective Action(s) Completed: Indicate corrective actions completed, if any. Use the numbers in the legend below the table. This column is a text column. You can type in anything you want.

Current Risk: Set the current risk. Use N, L, H. You can press the space bar to toggle through blank, N, L and H, or type N, L or H. N is no action required, L is low risk, and H is high risk. If you have not done corrective action, the current risk should reflect the highest chemical risk. If you have done corrective action, the current risk should reflect the effect of the corrective action on the risk, if any.

To Tier 3: If you are proposing a Tier 3 for the pathway set the column to “YES”, otherwise, leave the column at “NO”. Press Y to set “YES” or N to set “NO”. Press the space bar to toggle “YES/NO”.

### **11.5 Soil Leaching Corrective Action Map**

From the main form click the “Soil Leaching” button in the “Corrective Action Map” frame to activate the “Soil Leaching to Groundwater, Corrective Action Map” form. This form simply contours the soil concentration data to the Tier 1 levels for soil leaching to groundwater. Since you are required to remediate soil to the Tier 1 levels for soil leaching to groundwater, the map is an estimation of where soil remediation is required, based on the soil sample data entered into the software.

Interpolation Range: Click the button. Shown is the range of soil sample locations. I would suggest you set the interpolation ranges by subtracting approximately 50 feet from the minimum values and adding approximately 50 feet to the maximum ranges. You can round off the values to the nearest 10 feet. I would suggest an X and Y grid spacing of 5 feet for soil data. If you are using the example problem file, I have followed this suggestion.

Click the “Plot” button. The software simply plots the soil data to the Tier 1 levels for soil leaching, for all the chemicals.

You can send the plot to the printer or export it as a DXF file.

The soil leaching corrective action map is required as part of the Tier 2 Bedrock report.

## 12.0 SOIL VAPOR TO ENCLOSED SPACE PATHWAY

As noted in the rules and guidance, Soil Vapor to Enclosed Space is evaluated using the normal Tier 2 procedures. Hence, the pathway is exactly the same as Tier 2/SMR. See the Tier 2 Guidance and Tier 2/SMR software user manual (version 2.50) for more detailed coverage of Soil Vapor to Enclosed Space Pathway.

This pathway may be redundant. For example, if you remediate the soil contamination to meet the Soil Leaching to Groundwater Ingestion pathway you will meet the soil target levels for Soil Vapor to Enclosed Space. In addition, if you meet the soil gas target levels required to clear the groundwater vapor to enclosed space pathway, at the soil sources, you would clear the Soil Vapor to Enclosed Space receptor types.

Pathway	Benzene mg/kg	Toluene mg/kg	Ethylbenzene mg/kg	Xylenes mg/kg	TEH- Diesel mg/kg	TEH- Waste Oil mg/kg
Soil Leaching	0.54	42	15	NA	3,800	NA
Soil Vapor Confined Space Residential	1.16	48	79	NA	47,500	NA
Soil Vapor Confined Space Nonresidential	2.19	75	124	NA	74,000	NA
Soil Vapor Sanitary Sewer Residential	2.32	96	158	NA	95,000	NA
Soil Vapor Sanitary Sewer Nonresidential	4.38	150	248	NA	148,000	NA

None the less, you are required to evaluate the Soil Vapor to Enclosed Space pathway. The evaluation process in the bedrock software is essentially the same as that in the Tier 2/SMR software.

### 12.1 Preliminary Pathway Evaluation

Click the “Prelim. Pathway” button in the main form. It is assumed you have opened the example problem file (t2bnongranexamp.t2b).

Evaluation requirements for the Soil Vapor to Enclosed Space pathway are shown in the second, or bottom table, by receptor type. For each chemical applicable to a receptor type “Pass” or “Fail” is shown. “Fail” means the maximum soil concentration exceeds the target level, “Pass” means it does not. If any chemical is “Fail”, “YES” is shown in the “Generate Receptor ID” column. If “YES” is shown in the “Generate Receptor ID” column for a receptor type, you need to generate the receptor identification plume, overlay it on your site map, and enter any receptors identified into the software.

If you have indicated that soil gas has failed at a soil source by your answers to the “Questions” (Soil:Soil Gas), the result will be shown as FSG for the chemical. If you have indicated soil gas passed at a soil source, this will be shown as PSG. If you have not done soil gas sampling at a soil source (based on answers in Soil:Soil Gas) only the “Pass” or “Fail” results based on soil concentrations are shown.

If soil gas failed at any soil source the “Failed Soil Gas” column will show “YES”, otherwise the column will show “NO”.

The receptor identification plumes for soil vapor are based only on soil concentrations. If you do not have to generate receptor identification plumes based on soil concentrations, but fail soil gas at a soil source, you will still need to address the soil gas problem.

## 12.2 Receptor Identification Plumes

Please return to the main form. We will now examine the receptor identification plumes for Soil Vapor to Enclosed Space. These are exactly the same as those for Tier 2/SMR. For more details on this pathway see the Tier 2/SMR software user manual coverage of the Soil Vapor to Enclosed Space pathway.

Click the “Soil Vapor/PWL” in the “Receptor ID” frame to activate the “Soil Vapor/Plastic Water Line/Receptor Identification” form. Select the “Receptor Type” in the drop down list box. The first 4 items are for Soil Vapor:

CSR: Soil Vapor to Confined Space Residential  
 CSNR: Soil Vapor to Confined Space Nonresidential  
 SSR: Soil Vapor to Sanitary Sewer Residential  
 SSNR: Soil Vapor to Sanitary Sewer Nonresidential

If the preliminary pathway evaluation has a “YES” for “Generate Receptor ID” for a receptor type, do so using this form.

The soil concentrations are contoured to the soil target levels for the receptor type. You need to set the interpolation range. Click “Interpolation Range”. Generally, I would recommend you set the minimum interpolation ranges to approximately 50 feet less than the minimum data ranges and the maximum interpolation ranges to approximately 50 feet more than the maximum data ranges, rounded off to the nearest 10 feet. For soil data I would recommend an X and Y grid spacing of 5 feet.

Click the “Plot” button. The software contours the soil concentrations to the target levels for the receptor type. The contour line is show in red. Green circles, with a fifty-foot radius centered on the contour line, are also shown.

Actual receptors exist if they fall within the green circles. That is if they are within 50 feet of soil concentrations equaling or exceeding the target level (within 50 feet of the red contour line). Potential receptors apply if they fall on or within the red contour line (where soil concentrations are contoured to equal or exceed the target level).

See the Tier 2/SMR software users manual (version 2.50) for more information on identifying receptors for the Soil Vapor to Enclosed Space pathway.

## 12.3 Entering Receptors

Receptors are identified and entered into the software in the same manner as for a normal Tier 2/SMR. Click the “Vapor” button in the “Receptors” frame to enter the Soil Vapor to Enclosed Space receptors. See the Tier 2/SMR software users manual for additional information.

## 12.4 Pathway Evaluation and Risk Classification

Risk evaluation and classification for Soil Vapor to Enclosed Space pathway follows the same procedure as a normal Tier 2. From the main form click the “Soil Vapor/PWL” button in the “Pathway Evaluation” frame to activate the “Soil Vapor/Soil to Plastic Water Line Risk Classification” form. One difference

from the Tier 2/SMR software is; you do not need to set the option on including preliminary pathway evaluation requirements in the risk classification. Preliminary pathway evaluation results are automatically included as part of the pathway evaluation.

The risk classification (N, L, H) is based on soil data only, unless you have indicated you have passed soil gas at a soil source (Soil:Soil Gas). If you have indicated you passed soil gas sampling at a soil source, then this will clear the receptor (risk of N), if the risk classification is not already N based on soil data.

If you indicated that soil gas has failed at a soil source, this is shown as FSG (“L/FSG”). Failing soil gas does not affect the risk classification. If you have indicated you failed soil gas at a soil source, then the risk classification is based only on soil data. You could, for example, have a result of “N/FSG” for a chemical. This means no further action based on the soil concentration data, but in the “Questions” (Soil:Soil Gas) you have indicated soil gas sampling failed at the soil source for the chemical.

See the Tier 2/SMR Software User Manual (version 2.50), Section 13.0 for additional information on completing this pathway.

### 13.0 SOIL TO PLASTIC WATER LINE PATHWAY

The Soil to Plastic Water Line Pathway is the same for Tier 2 Bedrock and Tier 2/SMR. See the Tier 2 Guidance and Tier 2/SMR Software Users Manual for additional information on the pathway.

In some ways this pathway is redundant. For example, if you remediate the soil contamination to meet the Soil Leaching to Groundwater Ingestion pathway you will meet the target levels for Soil to Plastic Water Line;

Pathway	Benzene mg/kg	Toluene mg/kg	Ethylbenzene mg/kg	Xylenes mg/kg	TEH- Diesel mg/kg	TEH- Waste Oil mg/kg
Soil Leaching	0.54	42	15	NA	3,800	NA
Soil to Plastic Water Line	1.8	120	43	NA	10,500	NA

None the less, you are required to evaluate the Soil to Plastic Water Line pathway. The evaluation process in the bedrock software is essentially the same as that in the Tier 2/SMR software.

#### 13.1 Preliminary Pathway Evaluation

Click “Prelim. Pathway” button in the main form. It is assumed you have opened the example problem file (t2bnongranexamp.t2b).

Evaluation requirements for the “Soil to Plastic Water Line” pathway are shown as the last row in the top table. If you are required to do additional evaluation for the pathway “YES” is shown in the “Further Action Required” column. If “YES” is shown you need to generate the receptor identification plume for Soil to Plastic Water Line, overlay it on your site, and identify and enter into the software any actual plastic water lines within the plume.

To determine whether you need to generate a receptor identification plume the software simply compares the maximum soil concentration for each chemical to the target level for the pathway. If any target level is exceeded you are required to generate the receptor identification plume and identify receptors.

### 13.2 Receptor Identification Plumes

Return to the main form. We will now examine the receptor identification plumes for Soil to Plastic Water Line. These are exactly the same as those for Tier 2/SMR. For more details on this pathway see the Tier 2/SMR Software Users Manual coverage of the Soil to Plastic Water Line pathway.

Click the “Soil Vapor/PWL” button in the “Receptor ID” frame to activate the “Soil Vapor/Plastic Water Line/Receptor Identification” form. Select PWL (Plastic Water Line) as the “Receptor Type” in the drop down list box (the last item in the list).

PWL: Plastic Water Line

The soil concentrations will be contoured to the soil target levels for the receptor type. You need to set the interpolation range. Click “Interpolation Range”. Generally, I would recommend you set the minimum interpolation ranges to approximately 50 feet less than the minimum data ranges and the maximum interpolation ranges to approximately 50 feet more than the maximum data ranges, rounded off to the nearest 10 feet. For soil data I would recommend an X and Y grid spacing of 5 feet.

Click the “Plot” button. The software contours the soil concentrations to the target levels for the receptor type. The contour line is shown in red. Green circles, with a ten-foot radius centered on the contour line are also shown.

Actual plastic water lines are actual plastic water line receptors if they are within 10 feet of soil concentrations equaling or exceeding the target level (within 10 feet of the red contour, or on or within the green circles).

### 13.3 Entering Receptors

Plastic Water Line receptors for the Soil to Plastic Water Line pathway are entered into the software in the same manner as for a normal Tier 2/SMR. There is one processing difference for plastic water line receptors. From the main form click the “Plastic Water Line” button in the “Receptors” frame to activate the “Plastic Water Line Receptors” form. You will note there is a column “Receptor? Y/N”. Your selection for this column has no affect on the Soil to Plastic Water Line pathway (it does affect other pathways). All plastic water lines entered will be evaluated for the soil to plastic water line pathway. The software will determine whether a plastic water line falls within the Soil to Plastic Water Line receptor identification plume.

### 13.4 Pathway Evaluation and Risk Classification

Risk evaluation and risk classification for the Soil to Plastic Water pathway follows the same procedure as a normal Tier 2/SMR. From the main form click the “Soil Vapor/PWL” button in the “Pathway Evaluation” frame to activate the “Soil Vapor/Soil to Plastic Water Line Risk Classification” form. One difference from the Tier 2/SMR software is you do not need to set the option on including preliminary pathway evaluation requirements in the risk classification. Preliminary pathway evaluation results are automatically included as part of the pathway evaluation.

See the Tier 2 Guidance and Tier 2/SMR software users manual for additional information on the Soil to Plastic Water Line Pathway.

## 14.0 THE GROUNDWATER VAPOR TO ENCLOSED SPACE PATHWAY

The groundwater vapor to enclosed space pathway for bedrock is completely different than the groundwater vapor pathway for a normal Tier 2/SMR. The pathway is evaluated using only soil gas data. Please see Section 4.4 of the Tier 2 Guidance. The Groundwater Vapor to Enclosed Space Pathway is not affected by the classification of a site as non-granular or granular bedrock.

### 14.1 Defining the Soil Gas Plume

You are required to define the soil gas plume for Tier 2 Bedrock sites. You should take soil gas samples at locations where you might expect soil gas concentrations to be high. **Soil gas samples from three different spatial locations are required to evaluate the pathway. Note that this is not multiple samples within 10 feet of each other. This is samples from 3 different locations, at least 10 feet apart.** If any samples exceed the soil gas target levels you need to take soil gas samples as required to define the extent of the soil gas plume. The soil gas target levels are:

Benzene ( $\mu\text{g}/\text{m}^3$ )	Toluene ( $\mu\text{g}/\text{m}^3$ )
600,000	9,250,000

### 14.2 Soil Gas Data Analysis

Enter the soil gas data you have collected in the soil gas data form. Use the “Soil Gas Data” button in the “Soil Gas” frame on the main form.

Unlike the Soil Vapor to Enclosed Space pathway, the software does do analysis and reduction of the soil gas data for the Groundwater Vapor to Enclosed Space pathway. First, soil gas data samples are assigned a location. Soil gas samples within 10 feet of each other (radial distance) are treated as samples representing the same location. However, replacement soil gas sample points should be placed within 5 feet of the original sample point. Soil gas data assigned to the same location are evaluated together, for the purpose of assigning a concentration to a location. Again, after the soil gas data has been grouped (samples within 10 feet are combined), you need samples representing 3 different locations for the software to be able to evaluate the groundwater vapor to enclosed space pathway.

#### 14.2.1 The 14-day, 6-month rules

In assigning a soil gas concentration to a location, the samples at the same location are first sorted from oldest to most recent. For each chemical the maximum of the two most recent samples is assigned as the chemical concentration for a location, subject to the 14-day, 6-month rules. Rules require that soil gas samples from a location be separated by at least 14 days, and that a waiting period of 6 months is required after a soil gas sample exceeds a target level, before re-sampling.

At a location the concentration used is the maximum concentration for all samples between Date A and Date B, inclusive, where:

Date A is the date of the most recent soil gas sample.

Date B is the date of the first prior sample that is at least 14 days earlier than Date A. However, if a failing soil gas sample exists less than 6 months ( $\leq 180$  days) prior to Date B, then Date B is the date of the failing soil gas sample.

To make this more concrete, consider the following examples. The examples are for benzene, but the same process is applied for toluene.

Example 1:

Date	Concentration ( $\mu\text{g}/\text{m}^3$ )
12/01/2001	520,000
2/02/2002	467,000
2/20/2002	346,000

The concentration assigned in example 1 is 467,000, the maximum of the 2 most recent samples, because the last two samples are 14 or more days apart, and there is not a failing sample in the 6 months prior to 2/02/2002. That is Date A = 2/20/2002 and Date B = 2/02/2002 and the maximum of all samples between Date A and Date B, inclusive, is used.

Example 2:

Date	Concentration ( $\mu\text{g}/\text{m}^3$ )
12/01/2001	620,000
2/02/2002	467,000
2/20/2002	346,000

The concentration assigned in example 2 is 620,000. Although the 2 most recent samples meet the 14-day rule, there is a failing sample within 6 months of the 2<sup>nd</sup> of the 2 most recent. All three samples will be evaluated for the location. In this case Date A = 2/20/2002 and Date B = 12/01/2001, and the maximum concentration between Date A and Date B, inclusive, is used.

Example 3:

Date	Concentration ( $\mu\text{g}/\text{m}^3$ )
12/01/2001	578,000
2/02/2002	467,000
2/12/2002	346,000

The concentration assigned in example 3 is 578,000. The 2 most recent samples are not at least 14 days apart. The sample from 12/01/2001 is the first sample that is at least 14 days earlier than the most recent. The maximum concentration from the 3 samples will be assigned to the location.

If you have a single sample at a location, the concentration from the single sample will be assigned to the location. The maximum soil gas concentration for each chemical is the maximum from among the concentrations assigned to each location.

The concentrations assigned to a location are used for contouring and risk classification for the Groundwater Vapor to Enclosed Space pathway.

### 14.3 Preliminary Pathway Evaluation

From the main form click the “Prelim. Pathway” button. Evaluation requirements for the groundwater vapor pathway are shown in the seventh row, with a “Pathway/Receptor Type” label of “Groundwater



Vapor (Soil Gas)”. If the “Further Action Required” column is “YES” you need to generate the receptor identification plume.

It is assumed you have already adequately defined the soil gas plume and entered the soil gas data into the software. The software checks the soil gas data. If the target level for a chemical is exceeded at any location (maximum of 2 most recent samples, subject to 14-day, 6-month rules), you are required to generate the receptor identification plume, then enter any identified receptors into the software. If the maximum soil gas concentrations for both chemicals do not exceed the target levels you will not need to generate a receptor identification plume.

Please keep in mind that, ultimately, two soil gas samples are required at each sampling location. If you are performing the analysis with a single round of samples you may need to redo the pathway analysis when additional soil gas samples become available.

#### 14.4 Receptor Identification Plume

To generate the receptor identification plume for groundwater vapor, from the main form click the “Groundwater Vapor” button in the “Receptor ID” frame to activate the “Groundwater Vapor to Enclosed Space (Soil Gas), Receptor Identification” form. Click the “Interpolation Range” button. As usual, I would suggest you set the minimum interpolation range values to approximately 50 feet less than the minimum soil gas data ranges and the maximum interpolation range values to approximately 50 feet more than the maximum soil gas data ranges, rounded off to the nearest 10 feet. I would recommend an x and y grid spacing of 5 feet.

Click the “Plot” button. The software contours the soil gas data for benzene and toluene. The contours for Benzene ( $600,000 \mu\text{g}/\text{m}^3$ ) are shown in red and the contours for Toluene ( $9,250,000 \mu\text{g}/\text{m}^3$ ) are shown in the blue. Also shown are the labels for the soil gas sample points. If actual confined space or sanitary sewer receptors have already been entered into the software they are plotted, if the appropriate check box is checked under “Plot Receptors”. Since the soil gas target levels are the same for residential and nonresidential confined space and sanitary sewer receptors, there is only one receptor identification plume. The receptor identification plume is used to identify **actual** confined space residential and nonresidential receptors and **actual** sanitary sewer residential and nonresidential receptors.

Actual confined spaces (residential or nonresidential) are receptors if they are within 50 feet of the edge of the plume (red or blue contours). The green circles have a radius of 50 feet and are centered on the contours and may be used to estimate the area within 50 feet of the edge of the soil gas plumes.

Actual sanitary sewers (residential or nonresidential) are receptors if they pass through or within 50 feet of the contoured plumes (through or within the green circles) **and** enter a building within 200 feet.

For the Groundwater Vapor to Enclosed Space pathway you should only identify **actual** confined space residential and nonresidential receptors and **actual** sanitary sewer residential and nonresidential receptors. You should **not** identify **potential** confined space residential and nonresidential receptors and **potential** sanitary sewer residential and nonresidential receptors.

The method used to contour soil gas data is different from the method used to contour groundwater and soil data. Soil gas data is not interpolated. Interpolation is not used to define the edge of the plume. Only measurements less than or equal to the soil gas target level are considered the edge of the plume. To implement this in the software, for the purposes of contouring, soil gas concentrations less than the target levels are treated as equal to the target levels. This has the effect of pushing the contour lines out to the first locations where soil gas concentrations are less than the target levels.

See the Tier 2 Guidance and Tier 2/SMR software users manual for additional information on **actual** confined space and sanitary sewer receptors.

### 14.5 Entering Receptors

You enter **actual** confined space and sanitary sewer receptors for the Groundwater Vapor to Enclosed Space pathway in the usual manner, using the “Vapor” button in the “Receptors” frame on the main form. You only need to enter a receptor once. For example, if a receptor has already been entered due to the soil vapor pathway you do not need to enter it again. However, the length of the receptor may change based on the size of the receptor identification plume.

Again, you only enter **actual** confined space and sanitary sewer receptors (residential and nonresidential) for the Groundwater Vapor to Enclosed Space Pathway.

### 14.6 Pathway Evaluation and Risk Classification

From the main form click the “Groundwater Vapor” button in the “Pathway Evaluation” frame to activate the “Groundwater Vapor to Enclosed Space: Risk Classification and Receptor Summary” form. The risk classification results are shown in the top table.

It is assumed that you have adequately defined the soil gas plume, entered the soil gas data into the software, generated the groundwater vapor receptor identification plume, and identified and entered into the software any actual confined space or sanitary sewer receptors.

The first row in the table under “Receptor Type” is “PVRs”, which is a summary for Potential Vapor Receptors. This simply compares the maximum soil gas concentrations to the target levels. If the maximum soil gas concentration exceeds the target level for a chemical, the risk is low (L). Otherwise, the risk is no action required (N).

The second row, “AVRs”, is a summary for the actual vapor receptors. If any actual vapor receptor is high risk for a chemical, the risk for the chemical for “AVRs” is shown as H. Otherwise, the risk is N.

The remaining rows of the table list the actual vapor receptors (confined space and sanitary sewer, residential and nonresidential) entered into the software. The risk for a chemical is high (H) if the receptor falls within 50 feet of the soil gas data contoured to the target level for the chemical. Otherwise the risk is No Action Required (N). The results should correspond to the receptor identification plume for Groundwater Vapor to Enclosed Space. If a receptor is within 50 feet of the soil gas plume for a chemical it should be high risk for the chemical, otherwise the risk should be N.

As noted on the form the “Confirm. Samp.\*” column, confirmation sampling, is set automatically by the software. If you have at least two soil gas samples for each chemical at all soil gas sampling locations the column is set to “YES”, otherwise the column is set to “NO”. The two soil gas samples at all locations must also meet the 14-day, 6 months rules (see Section 14.2.1) in order for “Confirm. Samp. \*” to be “YES”. That is, the soil gas samples must be at least 14 days apart and there can not be a failing soil gas sample in the 6 months prior to the earlier sample. Generally you are required to have a minimum of two soil gas samples at all soil gas sampling locations before the pathway can be cleared.

Set the “Corrective Action(s) Completed” column and “To Tier 3” columns, as appropriate.

The “Current Risk” column should be set to the highest chemical risk for the row, unless you have completed a corrective action affecting the risk. In that case enter the appropriate risk after completion of the corrective action.

### **15.0 Soil Gas Monitoring Plan: Comments and Summary Table**

If you will be performing additional soil gas monitoring in the future you will need to complete and submit a soil gas-monitoring plan. You could be monitoring soil gas for either the Soil Vapor to Enclosed Space or Groundwater Vapor to Enclosed Space pathways. There are two parts to the plan, the summary table and your comments and justification. See the Tier 2 Guidance and SMR Guidance for additional information on soil gas monitoring for Bedrock sites.

To reach the summary table click the “Summary Table” button in the “Soil Gas Monitoring Plan” frame to activate the “Soil Gas Monitoring Plan Summary Table” form. Simply entered the required information.

Click “OK/Back”.

Click the “Comments/Justification” button in the “Soil Gas Monitoring Plan” frame to activate the “Soil Gas Monitoring Plan Comments/Justification (Report Page 21)” form. This is simply a text box where you enter any additional information or justification required for your soil gas monitoring plan.

Click “OK/Back”.

To print the Soil Gas Monitoring plan table and comments, click the “Print Menu” button and select the “Soil Gas Monitoring Plan Comments and Summary Table (Page 21)” item. This will print both the Comments/Justification and the Summary Table as page 21 of the Tier 2 Bedrock report.

### **16.0 WATER SUPPLY WELLS PATHWAY**

The Water Supply Wells pathway is unique to the bedrock software. You are required to identify and enter all drinking and nondrinking water wells within 1,000 feet and all public water supply wells within 1 mile. The Water Supply Wells pathway performs an evaluation of the water sample data collected at each water supply well.

The Water Supply Wells pathway is not affected by whether a site is non-granular or granular bedrock.

#### **16.1 Entering Water Supply Wells and Water Sample Data**

Click the “Water Supply Wells” button in the “Receptors” frame. This will activate two forms.

The “Tier 2-BEDROCK, Water Supply Wells” form is used to enter drinking water (DWW), nondrinking water (NDWW) and public water supply (PWSW) wells. There are separate tables for entering drinking water wells, nondrinking water wells and public water supply wells. To access these use the drop down button at the top left of the form. Be sure to answer the distance questions about whether drinking water wells and nondrinking water wells are within 1,000 ft of the suspected contamination source. Use Y to indicate Yes and N to indicate No. Set the drop down item to “Public Water Supply Wells”. Note there are two questions. Whether or not a public water supply well within 1 mile of the sources, and whether or not it is within 1,000 feet (added at version 1.20). Be sure to answer both questions.

The lower form, “Tier 2-BEDROCK, Water Sample Data at Water Supply Wells” is the form used to enter water sample data from the water supply wells. You must only enter water sample data taken from the water supply wells in this form. Enter the water sample data from all the water supply wells into the form. Do not enter groundwater sample data from monitoring wells into this form. Enter only groundwater sample data from drinking water wells, non-drinking water wells and public water supply wells. The software will determine which water samples are associated with which water supply wells using the x-y locations. The x-y location of a water sample from a particular water supply well must match the x-y location of the water supply well entered into the software.

The DNR has performed and continues to perform raw water sampling for public water supply wells that are near LUST sites with shallow bedrock. If you have public water supply wells within 1-mile check the Groundwater Professional Bulletin Board to determine if the wells have been sampled ([www.iowadnr.com/land/ust/gwpbulletinboard/ustgwpbbindex.html](http://www.iowadnr.com/land/ust/gwpbulletinboard/ustgwpbbindex.html)).

The Water Supply Wells pathway is **not** affected by whether or not you have identified the drinking and nondrinking well as being within 1,000 feet or the public water supply well as being within 1 mile.

Return to the main form.

## 16.2 Risk Classification and Monitoring Plan

Click the “Water Supply Wells” button in the “Pathway Evaluation” frame to activate the “Water Supply Wells, Risk Classification” form. The top table shows the risk classification for each water supply well, determined only using water sample data the well itself.

The “Active Receptor” column is set to “YES” for drinking water wells and nondrinking water wells if you have said they are within 1,000 feet in the receptor entry, and “YES” for public water supply wells if you have said they are within 1 mile in the receptor entry. Otherwise, the column is set to “NO”.

For a public water supply well, if you have indicated it is within 1,000 feet of the sources, this will be shown by “YES\*” under “Receptor Active”. The “YES” indicates within 1 mile and the “\*” indicates within 1,000 feet.

The software checks the maximum of the 2 most recent samples at each water supply well. If the concentration exceeds the target level the chemical is high risk (H). Otherwise the chemical is No Action Required (N). If you only have one sample at a water supply well the single sample concentrations are used for risk classification.

If no water sample data is found for a receptor (based on comparing the x-y location of a water supply well receptor to the x-y locations of the water sample data for water supply wells), “NoData” is shown.

Your task is to set the last 5 columns.

Confirm. Samp.: Confirmation Sampling. Set to “YES” if there are 2 or more samples at the well, otherwise set to “NO”.

Set the Corrective Action(s) completed, as appropriate.

Set the Current Risk column to the highest chemical risk, unless you have performed a corrective action affecting the risk classification.

To Tier 3: If you propose a Tier 3 evaluation for a receptor set to “YES”, otherwise set to “NO”.

### **Important: Set the Monitor Column**

Monitor: Use the column to set your monitoring plan for water supply wells. The default setting is “YES”, which means you will be doing additional water monitoring at the well. If you believe additional monitoring is not required at a particular water supply well set the column to “NO”. Your monitor selections will be printed when you print the Water Supply Wells Water Monitoring Plan (“Print Menu”).

To print the water monitoring plan for Water Supply Wells click the “Print Menu” button on the main form and select “Water Supply Wells, Water Monitoring Plan (Page 23)”. You set the monitoring plan using the last column in the Pathway Evaluation form for Water Supply Wells (“Water Supply Wells” in “Pathway Evaluation” frame).

## **17.0 GROUNDWATER INGESTION, GROUNDWATER TO PLASTIC WATER LINE, AND GROUNDWATER TO SURFACE WATER BODY PATHWAYS.**

The procedures used to evaluate the groundwater ingestion, groundwater to plastic water line and groundwater to surface water bodies are different for non-granular and granular bedrock sites. You should have already determined the designation that is appropriate for your site, and indicated the appropriate designation using the “General” button in the “Questions” frame.

### **17.1 Drinking water wells, non-drinking water wells and public water supply wells.**

There are no receptor identification plumes for the groundwater ingestion pathway. Instead, you are required to identify and enter into the software all drinking water wells and non-drinking water wells within 1,000 feet of the soil sources or the suspected location(s) of petroleum releases. This is true for both granular and non-granular bedrock sites. You are also required to sample said wells (Tier 2 Guidance, 4.3.2).

You are also required to identify and enter into the software all public drinking water wells within one mile of the soil sources or the suspected area(s) of petroleum release(s). This is true for both granular and non-granular bedrock sites. The DNR has completed raw water sampling for a number of public water supply wells in Iowa. You can check the Groundwater Professional Bulletin Board ([www.iowadnr.com/land/ust/gwpbulletinboard/ustgwpbbindex.html](http://www.iowadnr.com/land/ust/gwpbulletinboard/ustgwpbbindex.html)) for more information.

Be sure you have answered the questions appropriately regarding groundwater ingestion wells: “GW Ingestion” button in the “Questions” frame.

To enter Drinking Water Well (DWW), Nondrinking Water Well (NDWW) or Public Water Supply Well (PWSW) receptors into the software, click the “Water Supply Wells” button in the “Receptors” frame. You will note that for Drinking Water Wells and Nondrinking Water Wells there is a column “Within 1,000 ft? (Y/N)”. Be sure to set this column appropriately. This is for the case in which you have identified a well greater than 1,000 feet from the sources, but you wish to document the receptor. If the column is set to “N” the receptor will not be counted as a drinking water well or nondrinking water well for risk evaluation purposes for the groundwater ingestion pathway for granular bedrock. However, all water supply wells will be evaluated in the Water Supply Wells pathway, regardless of their distance from the source.

The Public Water Supply Well (PWSW) is a new receptor type. Again be sure to set correctly whether the receptor falls within the specified distance from the source, in this case 1 mile from the source(s). Also,

be sure to correctly set whether a public water supply well is within 1,000 feet of the source(s). Under non-granular bedrock, the risk classification criteria for public water supply wells depends on whether it is within 1,000 of the sources, or more than 1,000 feet from the sources.

Under Preliminary Pathway Evaluation requirements (“Prelim. Pathway” button) the results simply note you are required to identify and enter all drinking and nondrinking water wells within 1000 feet and all public water supply wells within 1 mile.

There are no protected groundwater source receptors to enter for bedrock. A protected groundwater source receptor is assumed. Since groundwater transport modeling is not done there is no method for calculating groundwater source SSTLs for off-site protected groundwater sources. The software assumes you have to meet groundwater target levels for protected groundwater sources at all monitoring wells.

## **18.0 NON-GRANULAR BEDROCK**

We now turn to the evaluation of the Groundwater Ingestion, Groundwater to Plastic Water Line and Groundwater to Surface Water Body pathway for the case of “Non-granular” bedrock. As noted, the procedures are different for non-granular and granular bedrock. When we are talking about non-granular bedrock, we include the Groundwater Ingestion, Groundwater to Plastic Water Line, and Groundwater to Surface Water Body pathways.

For evaluation of the groundwater ingestion pathway to be correct you need to have correctly answered the questions under “GW Ingestion” in the “Questions” frame, particularly with regard to whether or not water supply wells exist within the specified distances. The software uses your answers to determine whether the drinking water well receptor type, the nondrinking water well receptor type, or the public water supply well receptor type is present for non-granular bedrock, and the risk classification criteria required for public water supply wells.

### **18.1 Preliminary Pathway Evaluation for Groundwater to Plastic Water Line**

Click “Prelim. Pathway”. The requirements for Groundwater to Plastic Water Line are shown in the row for “GW to Plastic Water Line”. Further action will be required, namely the generation of a receptor identification plume and identification of receptors, unless the depth to groundwater is greater than 20 feet or the maximum groundwater concentrations (from monitoring wells only) are less than the target levels for the receptor type.

If “Further Action Required.” is “YES”, you need to perform the actions in the “Comments/Requirements” column.

### **18.2 Receptor Identification for Groundwater to Plastic Water Line**

If you are required to generate a receptor identification plume for groundwater to plastic water line click the “GW to PWL/SWB” button in the “Receptor ID” frame. For non-granular bedrock, interpolation of groundwater data is not done. The “Interpolation Range” button will be disabled. Click the “Plot” button. The receptor identification plume is generated by drawing a 200-foot radius circle around each monitoring well with a concentration exceeding the target level for the receptor type. Only data at monitoring wells is evaluated (groundwater sample data at water supply wells are not used). For the purposes of receptor identification the maximum of the two most recent samples, or the most recent sample if steady and declining is met, is used to assign a chemical concentration to a monitoring well.

Overlay the receptor identification plume on your site. Identify and enter into the software any actual plastic water lines falling on or within the plume(s) (the 200 foot circles).

### 18.3 Entering Plastic Water Line Receptors

From the main form click the “Plastic Water Line” button in the “Receptors” frame to activate the “Plastic Water Line Receptors” form. You use the “Receptor? Y/N” column to indicate whether or not a plastic water line is a receptor for groundwater to plastic water line. If a plastic water line falls within the Groundwater to Plastic Water Line receptor identification plume set the column to “Y”, otherwise set the column to “N”. If you have a plastic water line as a receptor for soil to plastic water line, but it is not a receptor for groundwater to plastic water line, set the column to “N”. Also recall an actual plastic water line is not a receptor for the groundwater to plastic water line pathway if, the highest groundwater elevation expected beneath the plastic water line is more than 3 feet below the bottom of the plastic water line.

Again, if you set the “Receptor? Y/N” to “Y” you are indicating, and the software will assume, the plastic water line is a receptor for the Groundwater to Plastic Water Line pathway. If you set the “Receptor? Y/N” to “N” you are indicating, and the software will assume, the plastic water line is not a receptor for the Groundwater to Plastic Water Line pathway. **It is up to you to set the “Receptor? Y/N” column correctly.**

### 18.4 Preliminary Pathway Evaluation for Groundwater to Surface Water Body

It is assumed you have correctly answered the “Questions” regarding “SW: Designated” and “SW: General”. From the main form click the “Prelim. Pathway Eval.” button. Your evaluation requirements for Groundwater to Surface Water Bodies are shown in two rows, “GW to SWB: Designated” and “GW to SWB: General”. If further action is required generate the receptor identification plumes for the receptor type(s) identified in “Comments/Requirements”.

The results are based on three factors. One factor is your answers to the questions regarding designated use and general use surface water bodies (“SW:Designated” and “SW:General” buttons in the “Questions” frame). It is important that you have answered the questions correctly.

The other factors are the maximum groundwater concentrations at the monitoring wells and the maximum soil concentrations. For example, suppose you have indicated a designated use surface water body is present within 500 feet. The maximum groundwater concentrations are compared to the groundwater target levels for the receptor type and the maximum soil concentrations are compared to the soil target levels for soil leaching to groundwater. If they exceed a target level, you are required to generate a receptor identification plume. If no target level is exceeded, you are not required to generate a receptor identification plume.

### 18.5 Receptor Identification Plumes for Surface Water Bodies

On the main form click “GW to PWL/SWB” in the “Receptor ID” frame to activate the “Receptor Identification: GW to PWL and GW to SWB, Non-Granular” form. As an example select “DU:B(CW)” as the receptor type and click “Plot”. Circles with a radius of 200 feet are generated at each groundwater monitoring well that exceeds the groundwater target level for a chemical for the receptor type and at each soil source location where the soil concentration exceeds the Tier 1 level for soil leaching to groundwater.

If you need to generate a receptor identification plume for a surface water body, overlay the plume map on your site map and identify and enter into the software all receptors of the type falling on or within a plume (200 foot circle).

## 18.6 Entering Surface Water Body Receptors

To enter a surface water body receptor, from the main form click the “Surface Water” button in the “Receptors” frame to activate the “Surface Water Receptors” form. If the receptor falls within a receptor identification plume be sure to set “Receptor? Y/N” to Y. Normally, you would not need to enter a receptor not falling within the receptor identification plume. If for some reason you do enter a receptor not falling within the receptor identification plume for the receptor type, set “Receptor? Y/N” to “N”. **It is up to you to correctly identify a surface water body receptor falling within the receptor identification plume by setting the “Receptor? Y/N” column. The software uses your answer to determine whether the Surface Water Body receptor type exists for non-granular bedrock.**

Unlike Tier 2/SMR, there is no way for bedrock to compute a Q value (allowable discharge) in order to request a modified target level as discussed in the Guidance, 3.7.5. Although both the Rules and Guidance talk about calculating an allowable discharge concentration for bedrock, this can not be done for bedrock because groundwater contaminant transport modeling is not done. The default target levels are used for surface water bodies.

## 18.7 Non-Granular Monitoring Plan and Risk Classification Plan

To specify the monitoring plan and risk classification plan for non-granular bedrock, click the “Monitoring Plan” button in the “Non-Granular” frame to activate the “Non-Granular Bedrock, Groundwater Monitoring Plan” form. This form simply lists all locations currently represented in the groundwater sample data from monitoring wells.

### Monitoring Plan

The default choice for non-granular bedrock is to continue to sample all monitoring wells. If, for some reason, you plan to not sample a well in the future set the “Monitor (Annual) (Y/N)” column to “NO” by typing N in the column, or by pressing the space bar to toggle the setting. If you choose to not monitor a well you must provide justification. Enter any required justification in the text box at the bottom of the form. This plan is for the sampling of monitoring wells only, and does not include the sampling of water supply wells. Recall that your plan for monitoring water supply wells is generated elsewhere (see section 16).

### Risk Classification Plan

The column “Risk Class. Plan”, for Risk Classification Plan, is used to identify the wells that will be used for risk classification. The default is to use all the monitoring wells. The groundwater sample data at a well with “YES” will be used for risk classification. The groundwater sample data at a well with “NO” will not be used for risk classification. Generally, you are required to use all the monitoring wells for risk classification. If you do not use a well for risk classification, you must provide a thorough justification in the text box at the bottom of the form. Even if you will not monitor a well in the future, you are required to use the well for risk classification, unless adequate justification is provided.

You should set the non-granular bedrock risk classification plan prior to completing the pathway evaluation.



For our example problem we will monitor all the wells for non-granular bedrock and we will use all the wells for risk classification

### 18.8 Non-Granular Monitoring Map

From the main form click the “Monitoring Map” button in the “Non-Granular” frame to activate the “Non-Granular Monitoring Map” form. The monitoring map will show the monitoring wells in the Non-granular monitoring plan. You can also plot any and all receptors appropriate to the pathway. The table lists all the drinking water wells, non-drinking water wells, public water supply wells, plastic water lines and surface water body receptors entered into the software. To select which receptors to plot check the row in the “Plot” column. A check means the receptor will be plotted.

Click the “Plot” button. Monitoring wells in the non-granular monitoring plan are shown with a red label. Monitoring wells not in the non-granular monitoring plan are shown with a black label. You set/change wells in the non-granular monitoring plan as described in the previous section.

Click “Print”, then “Preview”. Wells in the monitoring plan are shown with a bold and underlined label.

If you export the map as a DXF file, wells in the monitoring well will have the label MP. For example, if MW-1 is in the monitoring plan it will be shown as “MP: MW-1”. If it is not in the monitoring plan only the well label is shown, “MW-1”.

### 18.9 Non-Granular Bedrock Pathway Evaluation and Risk Classification Criteria

To view the Pathway Evaluation and Risk Classification for non-granular bedrock, from the main form click the “GW Ingest, PWL, SWB” button in the “Pathway Evaluation” frame to activate the “Tier 2-BEDROCK, Groundwater Ingestion, Risk Classification” form. The table shows the risk classifications for non-granular bedrock for the pathways.

The groundwater concentration data from all the monitoring wells in the non-granular risk classification plan are used for risk classification (see Section 18.7).

If you have indicated there is not a groundwater monitoring well(s) at the soil source(s) (“General” button in the “Questions” frame), one of the requirements for a No Action Required (N) risk classification is a minimum of 3 annual samples at each monitoring well in the risk classification plan.

If there is a groundwater monitoring well(s) at the soil source(s), only the most recent sample at each monitoring well in the risk classification plan is used for risk classification.

If a well in the risk classification plan has never been sampled for a chemical, said well will be ignored with regard to risk classification, for that chemical. If a well in the risk classification plan has even been sampled for a chemical, the well data will be used for risk classification for that chemical.

**PGWS: Protected Groundwater Source.** A protected groundwater source is assumed.

The risk is low (L) unless no action required criteria are met.

No Action Required Risk Classification:

There is not a groundwater monitoring well(s) at the soil source(s).

3 annual samples at all monitoring wells in the risk classification plan.  
 3 most recent annual samples at all monitoring wells in the risk classification plan must not exceed the groundwater target levels for the receptor type.

There is a groundwater monitoring well(s) at the soil source(s).

At least 1 sample at all monitoring wells in the risk classification plan.  
 Most recent sample at all monitoring wells in the risk classification plan must not exceed the groundwater target levels for the receptor type.

**NDWWs: Nondrinking water well receptor type.** This receptor type exists for non-granular bedrock if one or more non-drinking water wells are present within 1,000 feet of the sources. The software determines if the receptor type is present based on **your** answer to the question (“GW Ingestion” button in “Questions” frame), “Non-Drinking Water Wells are present within 1,000\*\* feet?”.

**DWWs: Drinking water well receptor type.** This receptor type exists for non-granular bedrock if one or more drinking water wells are present within 1000 feet of the sources. The software determines if the receptor type is present based on your answer to the question (“GW Ingestion” button in “Questions” frame), “Drinking Water Wells are present within 1,000\*\* feet?”.

Risk classification criteria for NDWW and DWW types;

The risk classification criteria if a groundwater monitoring well(s) is not present at the soil source(s) are:

High Risk: Three most recent annual samples at all monitoring wells in the non-granular risk classification plan are examined. If any sample exceeds a target level for the receptor type, the receptor type is high risk for the chemical.

No Action Required: A minimum of three annual samples at all monitoring wells in the non-granular risk classification plan. Three most recent annual samples at all monitoring wells in the risk classification plan must not exceed the target levels for the receptor type.

Low Risk: If the risk is not high or no action required, the risk is low.

Risk classification criteria if there is a groundwater monitoring well(s) at the soil source(s):

High Risk: The most recent sample at all groundwater monitoring wells in the non-granular risk classification plan are examined. If any sample exceeds a target level for the receptor type, the receptor type is high risk for the chemical.

No Action Required: The most recent sample at all monitoring wells in the non-granular risk classification plan do not exceed the target levels for the receptor type.

Low Risk: If the risk is not high or no action required, the risk is low.

**PWSWs: Public Water Supply Well Type.** The software determines if the receptor type exists based on your answer to the question (“GW Ingestion” button in “Questions” frame), “Public Water Supply Wells are present with 1\*\* mile?”.

Note: When examining groundwater sample data for public water supply wells, the software only examines groundwater sample data from public water supply well receptors (PWSW) entered into the software for which you have answered “Y” for “Within 1 mile? (Y/N)”.

Risk classification if there is not a groundwater monitoring well(s) at the soil source(s):

High Risk: A groundwater sample (maximum of 2 most recent) at a public water supply well within 1 mile is greater than 40% of Tier 1 levels for a drinking water well. A sample (3 most recent annual samples) at a monitoring well in the non-granular risk classification plan exceeds a target level for the drinking water well type.

No Action Required:

Groundwater samples (maximum of two most recent) at public water supply wells within 1 mile do not exceed 40% of target levels for the drinking water well type, **or**, there are three annual samples from all monitoring wells in the risk classification plan, and none of the three most recent annual samples exceeds a target level for the drinking water well type.

Low Risk: If a chemical is not high risk or no action required, it is low risk.

Risk classification if there is a groundwater monitoring well(s) at the soil source(s):

High Risk: groundwater sample (maximum of 2 most recent samples) at a public water supply well within 1 mile is greater than 40% of Tier 1 levels for a drinking water well. The most recent sample at a monitoring well in the non-granular risk classification plan exceeds a target level for the drinking water well type.

No Action Required:

Groundwater samples (maximum of two most recent) at public water supply wells within 1 mile do not exceed 40% of target levels for the drinking water well type, **or**, the most recent samples at each monitoring well in the risk classification plan do not exceed the target levels for the drinking water well type.

Low Risk: If a chemical is not high risk or no action required, it is low risk.

**Public Water Supply Well within 1,000 feet:** For the public water supply well type, addition criteria is applied if a public water supply well exists within 1,000 feet of the sources. This is based on your answer to the question (“GW Ingestion” button in “Questions” frame), “Public Water Supply Wells are present with 1,000\*\* feet?”. If a public water supply well is present within 1,000 feet, the drinking water well risk classification criteria are also applied. That is, for a public water supply well within 1,000 feet, two risk classification criteria are applied. The risk classification criteria for public water supply wells within 1 mile, discussed above, and the risk classification criteria for drinking water wells within 1,000 feet, also discussed above. The highest risk from application of the 2 criteria is then applied for the public water supply well receptor type for each chemical. When this situation occurs, it is indicated by the use of \* in the receptor column. That is, when the criteria for a public water supply well within 1,000 feet has been applied, the “Receptor” is shown as “PWSWs\*”. Otherwise, the “Receptor” is shown as “PWSWs”.

**PWLs: Plastic Water Line Receptor Type.** The plastic water line receptor type exists if you have entered plastic water line receptors into the software and one or more of the plastic water line receptors have “Y” for “Receptor? Y/N”. By selecting “Y” for “Receptor? Y/N” you are informing the software a

plastic water line falls in the receptor identification plume and the highest expected groundwater elevation is less than 3 feet below the bottom of the plastic water line. **You are required to correctly identify whether or not a plastic water line is a receptor for the groundwater to plastic water line pathway.**

#### Risk Classification Criteria

If you have the plastic water line receptor type, the risk classification criteria are exactly the same as for the NDWW receptor type for non-granular bedrock (and in fact the groundwater target levels are the same). Please see the risk classification criteria for the NDWW receptor type for non-granular bedrock.

#### **SWBs: Surface Water Bodies Receptor Type**

The software checks the surface water body receptors, if any, you have entered into the software. If any surface water body receptor type has “Y” for “Receptor? Y/N” then the surface water body receptor type exists. **You are required to correctly identify whether surface water bodies are receptors for the groundwater to surface water body pathway by correctly setting the “Receptor? Y/N” column in the grid where surface water body receptors are entered into the software.**

If the surface water body receptor type exists the software determines the target levels for the surface water body receptor type by finding the minimum target level for each chemical from among the target levels for each surface water body receptor having “Y” for “Receptor? Y/N”.

#### Risk Classification

The risk classification criteria for the Surface Water Body receptor type are the same as the risk classification criteria for DWWs and NDWWs, except the groundwater target levels for the surface water body receptor type are used.

### **19.0 GRANULAR BEDROCK**

The procedures for the groundwater ingestion, groundwater to plastic water line and groundwater to surface water body pathway are different for granular and non-granular bedrock. If your site is granular bedrock make sure you set the bedrock category to granular (“General” button in the “Questions” frame). The software uses your selection for the bedrock category to determine if granular bedrock methods are used to evaluate the pathways. Granular bedrock affects the Groundwater Ingestion, Groundwater to Plastic Water Line, and Groundwater to Surface Water Body pathways.

The existence or non-existence of a groundwater monitoring well(s) at the soil source(s) has no affect on granular bedrock risk assessment.

The selection of granular versus non-granular only affects the groundwater ingestion, groundwater to plastic water line, and groundwater to surface water body pathways. The soil vapor to enclosed space, soil to plastic water line, groundwater vapor to enclosed space, and water supply wells pathways are not affected.

To follow along using the example problem for granular bedrock, open the example problem file t2bgranexamp.t2b.

For granular bedrock you must assign T (transition) and G (guard) or Sentry Wells to each receptor for each chemical of concern. The G well and Sentry well serve the same purpose. You assign a G well to a receptor or a Sentry well, but not both.

### 19.1 Preliminary Pathway Evaluation, Groundwater Ingestion Wells

If you click the “Prelim. Pathway” Button you will note you are required to identify and enter into the software all drinking water wells and non-drinking water wells within 1000 feet and all public water supply wells within 1 mile.

### 19.2 Receptor Identification Plumes, Groundwater Ingestion Wells

There are no receptor identification plumes for groundwater ingestion wells. You are required to enter all drinking water wells and non-drinking water wells within 1000 feet. You are required to enter all public water supply wells within 1 mile.

### 19.3 Preliminary Pathway Evaluation for Groundwater to Plastic Water Line.

The preliminary pathway evaluation for Groundwater to Plastic Water Line is the same for granular and non-granular bedrock. See Section 18.1.

### 19.4 Receptor Identification for Groundwater to Plastic Water Line

If you are required to generate the receptor identification plume for Groundwater to Plastic Water Line click the “GW to PWL/SWB” button in the “Receptor ID” frame to activate the “Receptor Identification: GW to PWL and GW to SWB, Granular” form. If you have identified your site as granular, “Granular” will be the last word in the form title.

For granular bedrock, contouring of the groundwater sample data is done and the “Interpolation Range” button is enabled. Click the “Interpolation Range” button. Again, I would suggest you initially set the minimum interpolation ranges to 50 feet less than the minimum data ranges (rounded off to the nearest 10 feet) and set the maximum interpolation ranges to 50 feet more than the maximum data ranges (rounded off to the nearest 10 feet). I would set the x and y grid spacing to 5 or 10 feet.

Click “Plot”. The receptor identification plume draws a circle of 200-foot (blue) radius around each monitoring well location exceeding the target level for the receptor type (as is done for non-granular bedrock).

The software also contours the groundwater data to the target levels (red). Circles with a radius of 200 feet (green) are centered on the contour lines. The outer edges of the green circles approximate a distance of 200 feet from the edge of the contoured groundwater data.

Actual plastic water lines are receptors if: they fall on or within a blue circle or on or within a green circle, and the highest expected groundwater elevation is less than 3 feet below the bottom of the plastic water line. Or to state it another way, a plastic water line is a receptor if: it is within 200 feet of where contoured concentrations exceed the target level or within 200 feet of a monitoring well whose concentrations exceed the target level, and the highest expected groundwater elevation is less than 3 feet below the bottom of the plastic water line.

You overlay the receptor identification plume on your site map, identify any actual plastic water lines within the plume, and enter them into the software. If a plastic water line is a receptor for the pathway (falls within the receptor identification plume) make sure you set the “Receptor? Y/N” column to “Y”. **It is up to you to correctly set the column to identify a plastic water line as a receptor for the groundwater to plastic water line pathway.**

### 19.5 Preliminary Pathway Evaluation for Groundwater to Surface Water Body

The Preliminary pathway evaluation for Groundwater to Surface Water Body is the same for granular and non-granular bedrock. Please see Section 18.4 for a description.

### 19.6 Receptor Identification for Groundwater to Surface Water Body

You need to generate receptor identification plumes for the types of designated use and general use, if any, identified in the preliminary pathway evaluation.

To generate receptor identification plumes for groundwater to surface water bodies click the “GW to PWL/SWB” button in the “Receptor ID” frame.

For our example problem set the “Receptor Type” to “DU:B(CW)”, set the interpolation range and click “Plot”. The receptor identification plume for granular bedrock is the same as for non-granular bedrock, except; the groundwater data is contoured to the target levels for the receptor type and 200 foot circles are drawn centered on the contours in order to approximate the area within 200 feet of the contours.

A surface water body is a receptor if it falls within 200 feet of a monitoring well where a target level is exceeded or is within 200 feet of contoured groundwater concentrations exceeding the target level. In other words, if it falls on or within any of the circles on the plot.

Overlay the receptor identification plume on your site map, identify the receptor types, if any, on or within any portion of the receptor identification plume, and enter the identified receptors into the software. If a surface water body falls within the receptor identification plume make sure you set the “Receptor? Y/N” column to “Y”. **You are required to correctly set the “Receptor? Y/N” column to correctly identify receptors for the groundwater to surface water body pathway. The software assumes your identification is correct.**

### 19.7 T and G/Sentry Well Selection

For granular bedrock you must select T and G/Sentry wells for groundwater ingestion, groundwater to plastic water line and groundwater to surface water body receptors. The receptors are evaluated using your T and G/Sentry well selections.

One of the requirements for no action required classification for a receptor-chemical is the selection of a T and G/Sentry well.

The software will assume the following receptors you have entered into the software are receptors for granular bedrock, for which T and G/Sentry well selection is required, and for which risk classification will be done. These are questions you answer when you enter receptors into the software (reached through the buttons in the “Receptors” frame).

Drinking Water Well receptors: You have entered “Y” for “Within 1000 feet?”.

Nondrinking Water Well receptors: You have entered “Y” for “Within 1000 feet?”.

Public Water Supply Well receptors: You have entered “Y” for “Within 1 mile?”.

Plastic Water Line receptors: You have entered “Y” for “Receptor?”.

Surface Water Body receptors: You have entered “Y” for “Receptor?”

Click the “T and G/Sen Wells” button in the “Granular MW Select” frame to activate the “Granular Bedrock, T and G/Sentry Monitoring Well Selection” form. The top drop down list box lists the following;

PGWS: Protected groundwater source (assumed for bedrock).

Followed by all drinking water wells, non-drinking water wells, plastic water line receptors and surface water bodies entered into the software, and identified as receptors.

For each of these receptors, **and for each chemical**, you are required to identify a T well and a G/Sentry well. See 5.4.10 of the Guidance for additional information on monitoring well selection for granular bedrock.

For protected groundwater source you are required to identify a transition and guard well in the main plume flow direction. You will need to estimate the main plume flow direction from your groundwater chemical concentration data and groundwater head data.

*The following is from the Guidance, 5.4.10.*

*Transition and guard wells: For all actual groundwater receptors, except vapor receptors, identify a Transition (T) and Guard (G) well.*

*Sentry well: For actual water wells and surface water receptors, identify a Sentry well. A sentry well is between the source and the actual receptor, outside the defined plume and approximately 200 feet from the actual receptor. When a sentry well is required, it is substituted for the guard well. For alternative well placement, the certified groundwater professional must provide justification and obtain DNR approval.*

To continue with the example set the receptor type to “PGWS” and the chemical to Benzene. Click the “T Well(s)” button.

The grid at the bottom of the form lists all monitoring well locations, shows the most recent sample concentration for each chemical, and shows whether the well meets T well criteria or G well criteria. “T” is used to indicate a well that meets T well criteria for a chemical. “G” is used to indicate a well that meets G/Sentry well criteria. The T well criterion is - the well has been above non-detect at any time. The G well criterion is - the most recent sample does not exceed the receptor target level for the chemical.

The software does not distinguish G and Sentry wells when you make a selection. G well criteria and Sentry well criteria are the same; a well meeting G well criterion will meet Sentry well criterion. You need to select a G/Sentry well for each receptor and chemical. The well you select as a G/Sentry well will be a Sentry well for actual water wells and surface water receptors, and a G well for the other receptor types.

The wells meeting G criterion may vary with the receptor type and chemical because the target level varies with the receptor type and chemical.

The software allows you to select a well as a T well or G/Sentry well, even if the well does not meet the criteria for a T or G/Sentry well. If you select a well not meeting the well criteria you may need to justify

your selection. Depending on your site, you may not have properly located wells meeting T well criteria (above non-detect for any sample at the well). In that situation, if you use a well that does not meet T well criteria, you will need to provide justification.

Normally the T and G/Sentry well should not be the same well. However, the software will allow you to select the same well as the T and G/Sentry well. Again, in such a situation you would need to provide justification for your selections.

In some cases, you may not have suitability placed wells to serve as T or G/Sentry wells between the soil sources or suspected source of the petroleum contamination and a receptor. You may need to consider the installation of additional monitoring wells to serve as T or G/Sentry wells.

You select/deselect a well by clicking on the well label. A red label means the well has been selected, a black label means a well is not selected.

For our example select MW-5 as the T well.

Click “OK/Back”.

Click “G/Sen Well(s)”. Select MW-8 as the G well.

You need to repeat T and G/Sentry well selection for each chemical, although you may be able to use the same wells as T and G/Sentry wells for different chemicals. If you are using the example problem the well selection has been done for you for all chemicals.

Select “dww-1:travis” as the receptor from the top list box. Set the chemical to Benzene. Click the “T Well(s)” button. The software will plot actual receptors with blue labels. Select MW-2 as the T well for dww-1. Click “OK/Back”. Click “G/Sen Well(s)”. Select MW-6 as the G/Sentry well. Click “OK/Back”. For the example problem, MW-2 as already been selected as the T well for the other chemicals and MW-6 has been selected as the G/Sentry well for the other chemicals.

Select the next receptor, ndww-1, and set the T well to MW-3 and the G/Sentry well to MW-7 for Benzene. These selections have already been made for ndww-1 for the other chemicals.

Select the next receptor in the example problem, pwl-1. For Benzene set the T well to MW-9 and the G/Sentry well to MW-10. These selections have already been made for pwl-1 for the other chemicals.

Select the last receptor in the example problem, gu:bcw-1. For Benzene set the T well to MW-2 and the G/Sentry well to MW-6. These selections have already been made for gu:bcw-1 for the other chemicals.

Return to the main form.

## 19.8 Receptor Details

Click the “Receptor Details” button in the “Granular MW Select” frame to activate the “Granular Bedrock, GW Ingestion, PWL, SWB Receptor Details” form. This form summarizes the results for granular bedrock receptors. You select a receptor and chemical. The form shows the risk classification (Risk), the T well(s) and their status, and the G/Sentry well(s) and their status. The T and G/Sentry wells shown are the wells you have selected.



E wells apply only to the Protected Groundwater Source receptor. E wells are selected automatically by the software. A well is an E well if it is a monitoring well, if the most recent sample at the well is greater than the target level for the protected groundwater source receptor type, and the well has not already been selected as a T or G/Sentry well for the receptor-chemical.

You can print the results for any receptor-chemical using the “Print Menu” button on the form.

### **19.9 Risk Classification Criteria**

Strictly speaking a T well should have been above non-detect at some time, but this is not enforced in the risk classification. If a T well has not been above non-detect, this will be flagged in the report listing possible deficiencies.

The following describes the risk classification for granular bedrock receptors; in particular protected groundwater source, drinking water wells, non-drinking water wells, public water supply wells, plastic water lines and surface water bodies. The wells used to evaluate the risk are the T and G/Sentry wells you have assigned to a receptor-chemical. For protected groundwater source, the software assigned E wells are also used.

Having a T and G/Sentry well for a receptor-chemical is one of the requirements for no action required (N). It is not possible for a receptor-chemical to have a risk classification of N, unless it has been assigned at least one T well and at least one G/Sentry well.

#### Protected Groundwater Source, PGWS

Low Risk (L): The risk classification is low risk, if the criteria for No Action Required has not been met.

#### No Action Required (N)

E Wells: The most recent sample at all such wells must not exceed the target level for the receptor type.

T Well: Three samples at least 6 months apart. Must meet steady and declining criteria. Most recent sample cannot exceed the target level.

G Well: Three samples at least 6 months apart. Must meet steady and declining criteria. Most recent sample cannot exceed the target level.

#### Drinking Water Wells (DWW)

Low Risk (L): If the criteria for High Risk or No Action Required has not been met, the risk is low.

High Risk (H): If the most recent sample at a G well is greater than the target level, the risk is high.

#### No Action Required (N):

T Well: Three samples at least 6 months apart. Must meet steady and declining.

G/Sentry Well: Three samples at least 6 months apart. All three samples must not exceed the target level.

### Nondrinking Water Wells, NDWW

Low Risk (L): If the criteria for High Risk or No Action Required has not been met, the risk is low.

High Risk (H): If the most recent sample at a G well is greater than the target level, the risk is high.

No Action Required (N):

T Well: Three samples at least 6 months apart. Must meet steady and declining.

G/Sentry Well: Three samples at least 6 months apart. Must meet steady and declining. Most recent sample must not exceed the target level.

### Public Water Supply Wells, PWSW

The target levels for public water supply wells for granular bedrock are the same as drinking water wells.

Low Risk (L): If the criteria for High Risk or No Action Required has not been met, the risk is low.

High Risk (H): If the most recent sample at a G well is greater than the target level, the risk is high.

No Action Required (N):

T Well: Three samples at least 6 months apart. Must meet steady and declining.

G/Sentry Well: Three samples at least 6 months apart. All three samples must not exceed the target level.

### Plastic Water Line, PWL

The risk classification criteria for plastic water line are the same as the risk classification criteria for nondrinking water wells, except, of course, the target levels used are those appropriate for the receptor type (Plastic Water Lines and Nondrinking Water Wells happen to have the same target levels).

### Surface Water Bodies

The risk classification criteria for surface water bodies are the same as risk classification criteria for nondrinking water wells, except, of course, the target levels used are those appropriate for the receptor type.

## **19.10 Monitoring Maps**

From the main form click the “Monitoring Maps” button in the “Granular MW Select” frame to activate the “Granular Bedrock, Receptor Monitoring Maps” form. This form produces plots showing a receptor and the wells selected to monitor the receptor-chemical.

If you click “Plot” you can see the wells selected to monitor the “PGWS” receptor for Benzene. Wells in the monitoring plan are shown in red, with the well criteria following the well label. Protected groundwater source is an area, so no receptor is plotted. For the other receptor types, the receptor is shown on the plot.

You can print the monitoring maps to include in your Tier 2 report.

### 19.11 Pathway Evaluation

After selecting T and G/Sentry wells for the groundwater ingestion, groundwater to plastic water lines and groundwater to surface water receptors, you can view the summary risk classification. Click the “GW Ingest, PWL, SWB” button in the “Pathway Evaluation” frame to activate the “Tier 2-BEDROCK, Groundwater Ingestion, Risk Classification” form.

Note the “Bedrock Category:” at the top of the form is GRANULAR. The software automatically displays the appropriate results based on whether you have identified the site as granular or non-granular.

Shown in the top table is the risk classification determined by the software for each chemical, based on the T and G/Sentry wells (and the E wells the software assigned to PGWS) assigned to each receptor-chemical. It is not possible for a receptor-chemical to have a risk classification of N, unless it has been assigned at least 1 T well and at least 1 G/Sentry well.

The risk classification criteria are covered section 19.9.

As usual, you need to set the last four columns. You should set the current risk to the highest chemical risk. If any chemical is high risk the current risk is H. If there are no high risk chemicals, but one or more low risk chemicals the current risk is L. If there are no high risk or low risk chemicals, the current risk is N.

However, if you have performed a corrective action that affects the receptor risk classification (i.e. plugged a well) set the “Current Risk” column to reflect the appropriate risk classification. For example, if you plugged a well, the current risk would be N.

If you have completed a corrective action, use the legend in the grid at the bottom of the form to set the “Corrective Action(s) Completed” column. For example, if you plugged a non-drinking water well you would enter a 2 in the column. If you have completed multiple corrective actions, enter the numbers separated with commas (i.e. 6,7).

If the current risk should be N based on a corrective action, it is important that you set the “Current Risk” column to N. When the software assembles the groundwater monitoring plan for granular bedrock, it will include the monitoring wells for all receptor-chemicals that have a software calculated risk of L or H, unless the current risk has been set to N for the receptor.

### 19.12 Groundwater Monitoring Plan for Granular Bedrock

From the main form click the “Granular” button in the “GW Monitoring Plan” frame to activate the “Granular Bedrock, Groundwater Monitoring Plan” form. The software automatically generates the granular bedrock groundwater monitoring plan. When the software assembles the groundwater monitoring plan it will include the monitoring wells for all receptor-chemicals that have a risk of L or H, unless you have set the “Current Risk” to N. The monitoring plan is for the monitoring of groundwater monitoring wells. A separate plan is generated for monitoring water supply wells (see section 16, 16.2).

The default setting shows a summary plan, indicating the wells and receptor types being monitored. A well is shown in the monitoring plan if it needs to be monitored for any chemical.

Set the drop down list box to Benzene. For individual chemicals the table shows, the wells in the monitoring plan, the most recent sample at each well, the receptors the well is being used to monitor, the software computed chemical risk for the receptor-chemical, the well type (T, G, Sentry or E well), the chemical target level, and the minimum frequency of required monitoring.

The minimum frequency for all wells is annually, except for E wells. Only a single sample is required for an E-well, but the most recent sample for an E well must not exceed the target level.

The risk classification criteria for a T or G/Sentry requires samples at least six months apart, so the maximum sampling frequency for risk classification purposes is 6 months for T or G/Sentry wells.

Click the “Print” button. This brings up a print menu you can use to print out the monitoring plan. For each chemical, the number of wells in the monitoring plan is shown.

## **20.0 POSSIBLE DEFICIENCIES**

From the main form click the “Deficiencies” button. This brings up a list of “Possible” deficiencies in your report. Check this when you believe you are done with the report, and include a printout with your report. The objective is to assist you with your report. The emphasis is on “Possible”. A possible deficiency means you should evaluate the situation, and correct it if it is truly an error, or perhaps you need to provide a justification.

A “Possible” deficiency may not be a deficiency. The list is intended to warn you of potential problems. For example, the software may note you do not have two soil gas samples from all locations. This may be appropriate at the time if you are planning to take additional soil gas samples in the future. Or, for example, if you have selected the same monitoring well as a T and G for a receptor-chemical for granular bedrock, this will be noted. Provide justification if you feel this is appropriate. Or perhaps you have not selected a G well because a suitable well does not exist, but you plan to install one as part of your continued monitoring and evaluation of the site.

The software does not check for every possible error, so it is still important you follow the correct procedures for performing a Tier 2 assessment of a bedrock site.

To print the deficiencies, from the main form click the “Print Menu” button and select the “Possible Deficiencies” item.

## **21.0 PRINTING PATHWAY EVALUATION SUMMARIES**

Unlike Tier 2/SMR, which prints separate pathway evaluation summaries for each pathway, the Tier 2 Bedrock software prints all the pathway evaluations as a group. When you are done with the pathway evaluation summaries for all pathways, and are ready to print the results, click the “Print Menu” button on the main form. Select the “Tier 2 Bedrock Receptor Summaries (Page 7)” item.

## **22.0 GENERAL CONTOURING**

The Tier 2 bedrock software contains forms for general contouring of groundwater, soil, and soil gas data, reached by the buttons in the “General Contouring” frame. These perform essentially the same as for the Tier 2/SMR software. Please see the Tier 2/SMR Software User Manual (version 2.50) if you need additional information.

The groundwater contouring form contours the groundwater sample data from monitoring wells only. It does not include concentration data from water supply wells.

THE END